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Received

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Air Permits Section

May 5, 2015

Mark Cuilla, Title V Permits Branch Supervisor
NCDENR – Division of Air Quality
1641 Mail Service Center
Raleigh, North Carolina 27699-1641

**Subject: Air Permit Modification Application
Section 112(j) Boiler MACT Operating Limits
The University of North Carolina at Chapel Hill
Title V Air Permit No. 03069T32**

Dear Mr. Cuilla:

In compliance with Sections 2.1.A.4.h.i. and 2.1.A.4.i. of Title V Air Permit No. 03069T32, the University of North Carolina at Chapel Hill is providing three (3) copies of an air permit modification application for your review to add §112(j) Boiler MACT operating limits to the permit. The proposed operating limits are for limestone injection rates and oxygen trim concentrations to be monitored for continuous compliance demonstrations with the §112(j) mercury, HCl-equivalent, and carbon monoxide emission limits applicable to Boiler Nos. 6 and 7 at our Cogeneration Facility. The proposed operating limits are based on operating parameters recorded during §112(j) performance tests conducted on July 9-10, 2013, March 4-5, 2014, and December 17-18, 2014.

The application package also contains a permit application processing fee of \$918.00. Since there are no new emission sources with this application, there is no zoning consistency provided.

We appreciate your review of this application. If you have any questions or comments, please call me at (919) 962-5718 or Butch Smith of RST Engineering at (919) 810-9875 any time at your convenience.

Sincerely,

The University of North Carolina at Chapel Hill

MALACHY G. DONOHUE

Malachy G. Donohue
Environmental Affairs Manager

Permit Modification Application

Boiler Nos. 6 and 7 112(j) Boiler MACT Operating Limits

**The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina**

Facility ID # 6800043
Air Permit # 03069T32

Prepared For:
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May 2015

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I. Introduction

The University of North Carolina at Chapel Hill (University) operates a 760-acre campus located in Chapel Hill, North Carolina. The University's principal sources of regulated air pollutant emissions include a Cogeneration Facility on Cameron Avenue near the main campus and a Steam Plant on Manning Drive near the UNC Hospitals complex. Emission sources at the Cogeneration Facility include two (2) 323.17 MMBtu/hr coal, natural gas, wood, and distillate oil-fired boilers (Boiler Nos. 6 and 7) and one (1) 338 MMBtu/hr natural gas and distillate oil-fired boiler. Emission sources at the Manning Drive Steam Plant are two (2) 249 MMBtu/hr natural gas and distillate oil-fired boilers. In addition to the large boilers at the Cogeneration Facility and Manning Drive Steam Plant, the University is permitted to operate two 2,000 kW blackstart ^{for emergency} generators, eighty-five (85) emergency generators, three (3) diesel-fired fire pumps, and seventeen (17) small hotwater heaters/boilers located across the campus. The seventeen (17) small hotwater heaters/boilers include a 2.52 MMBtu/hr natural gas-fired steam boiler at Davie Hall.

The five (5) large boilers at the Cogeneration Facility and Manning Drive Steam Plant, and the small natural gas-fired boiler at Davie Hall are subject to the provisions of Section 112(j) of the Clean Air Act. A small 1.05 MMBtu/hr natural gas-fired water heater (ES-SB-15) also subject to 112(j) and currently listed in the Title V air permit has been removed from service. The University is required to conduct 112(j) compliance performance tests on Boiler Nos. 6 and 7 at the Cogeneration Facility. These two (2) boilers are equipped with limestone injection/baghouse air pollution control systems for the control of acid gases and particulate matter, including hydrogen chloride (HCl), mercury (Hg), and other hazardous metals regulated by the 112(j) Boiler MACT. During the 112(j) performance tests, the University is required to monitor the concurrent limestone injection rates and oxygen (O₂) trim concentrations to establish 112(j) operating limits to be monitored for continuous compliance demonstrations with the 112(j) emission limits for HCl-equivalents, Hg, and carbon monoxide (CO). The University's Title V air permit (#03069T32) stipulates that the University submit a permit modification application to incorporate the limestone injection rate and O₂ trim concentration operating limits into the Title V permit within 60-days following the N.C. Division of Air Quality's (DAQ) approval of the 112(j) performance test report. The initial 112(j) performance tests on Boiler Nos. 6 and 7 at the Cogeneration Facility were conducted on July 9-10, 2013. Compliance with all the 112(j) emission limits was demonstrated during the July 2013 tests. However, because the boilers were operated at only approximately 55% steam load during the July 2013 tests, DAQ deferred official written approval of these tests to avoid requiring the University to submit a permit application to incorporate limestone injection rate and O₂ trim concentration operating limits into the permit that would be based on <90% operating load conditions. Because of the low operating load conditions that were achievable during the initial July 2013 performance tests, the University conducted a second round of 112(j) performance tests on March 4-5, 2014 with both boilers operated at >90% operating steam load. The intent of this testing was to obtain data to set the required limestone injection rate and O₂ trim concentration operating limits based on testing of the boilers at >90% operating steam load conditions. Compliance with the 112(j) emission limits for PM, Hg, and HCl was again demonstrated during the March 2014 tests. However, during the March 2014 testing, the test contractor inadvertently failed to record the CO concentrations measured during the tests. As a result, the University scheduled a third round of

112(j) performance tests conducted on December 17-18, 2014 after campus steam demand increased to allow testing for all 112(j) regulated pollutants at >90% steam load operating conditions.

This permit modification application presents the proposed limestone injection rate and O₂ trim concentration operating limits to be monitored for continuous compliance demonstrations with the 112(j) emission limits for HCl-equivalent, Hg, and CO emissions. The proposed emission limits are based on the July 2013, March 2014, and December 2014 112(j) performance tests.

II. Background

Section 112 of the Clean Air Act (CAA) governs the regulation of hazardous air pollutants (HAPs). Under §112(d), the U.S. EPA is required to promulgate federal maximum achievable control technology (MACT) standards for specific industrial sources by deadlines specified in §112(e). In the event that the U.S. EPA fails to promulgate a standard by the §112(e) deadline, §112(j) requires the local permitting authority to issue permits to the sources that include MACT standards that the permitting authority determines on a case-by-case basis to be equivalent to the standards that would have been applied if U.S. EPA had issued a §112(d) regulation in a timely manner. On September 13, 2004, the U.S. EPA promulgated National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters at 40 CFR 63, Subpart DDDDD (Boiler MACT). This regulation established specific HAP emission limits for several subcategories of boilers, including existing large solid fuel-fired boilers (including coal and wood), and new and existing natural gas and oil fired boilers. However, on July 20, 2007, the U.S. Court of Appeals for the District of Columbia vacated the Boiler MACT in response to litigation from various environmental groups. The regulation was remanded to U.S. EPA for revision and re-issuance. Because of vacature of the September 13, 2004 promulgated Boiler MACT, the N.C. Division of Air Quality (DAQ) notified affected facilities by letter on June 17, 2009 that a §112(j) permit application was required to be submitted by September 11, 2009. In response to the June 17, 2009 letter, the University submitted a §112(j) permit application on September 9, 2009 based on DAQ guidance presented in a 112(j) model rule. The DAQ issued the University a revised Title V air permit on February 3, 2010 that incorporated 112(j) HAP emission limits for the University's boilers and process heaters. On December 21, 2012, the U.S. EPA reissued the federal Subpart DDDDD Boiler MACT that had been remanded for revision. However, as indicated in the University's Title V air permit, compliance under the 112(j) Boiler MACT provisions currently specified in the permit will be allowed in lieu of the revised federal Boiler MACT until May 23, 2019. The effective date of the 112(j) provisions for the University's boilers and process heaters was February 3, 2013. After May 23, 2019, the University will be required to comply with the federal 40 CFR 63, Subpart DDDDD Boiler MACT in lieu of the current 112(j) provisions.

III. Affected Sources and Control Device Descriptions

The University's Title V air permit presents 112(j) Boiler MACT emission limits, operating limits, work practice standards, and monitoring requirements that vary with the size (MMBtu/hr) of the boiler or process heater, and the types of fuels burned. All of the 112(j) regulated boilers

and process heaters at the University, with the exception of Boiler Nos. 6 and 7, are natural gas or distillate oil-fired units. Natural gas and distillate oil-fired units are not subject to any 112(j) operating limit requirements. Boiler Nos. 6 and 7 at the Cogeneration Facility are the only University boilers subject to 112(j) operating limit requirements. Boiler Nos. 6 and 7 are identical circulating fluidized-bed combustion units (CFBC) permitted for the firing of coal, No.2 fuel oil, natural gas, and wood-based fuels. Because of the fluidized-bed design and efficiency considerations, the units are usually operated entirely on coal or co-fired with coal and one of the other three fuels. Both boilers are rated at 323.17 MMBtu/hr and are equipped with a calcium carbonate (limestone) sorbent injection/baghouse control system. The boilers are also each equipped with a NO_x continuous emissions monitoring system (CEMs), a SO₂ CEMs, and a continuous opacity monitoring system (COMS) for compliance monitoring with the NSPS-Subpart Db emission limits. Each boiler is also equipped with a CO₂ analyzer system to provide diluent gas concentrations for conversion of CEMs measured NO_x and SO₂ concentrations (ppm) to the lbs/MMBtu format of the NSPS-Subpart Db emission limits. Although not required under the NSPS provisions, the coal firing rate, limestone injection rate, corresponding coal:limestone feed rate ratios, and oxygen (O₂) trim concentrations are monitored for boiler operational control purposes. Both boilers are also equipped with flue gas flow rate monitoring systems that provide data used to calculate NO_x and CO₂ mass emissions (tons/reporting period) for reporting ozone season NO_x emissions under the NO_x budget program and CO₂ emissions under the Greenhouse Gas reporting program.

IV. Summary of 112(j) Compliance Requirements for Boiler Nos. 6 and 7

The University's Title V air permit presents 112(j) Boiler MACT emission limits, operating limits, work practice standards, and monitoring requirements that vary with the size (MMBtu/hr) of the boiler or process heater, and the type of fuel burned. As noted above, Boiler Nos. 6 and 7 at the Cogeneration Facility are the only units subject to 112(j) operating limit requirements addressed in this permit application. The 112(j) compliance requirements applicable to Boiler Nos. 6 and 7 are discussed below.

Boiler Nos. 6 and 7 (323.17 MMBtu/hr each) are larger than the DAQ's 112(j) model rule large unit classification threshold (>100 MMBtu/hr). The 112(j) Boiler MACT emission limits for Boiler Nos. 6 and 7 when burning coal are 0.08 lb/MMBtu- filterable particulate (PM); 3.0E-06 lb/MMBtu-mercury (Hg); 435.5 lb/hr hydrogen chloride equivalent emissions (HCl-eq.); and 133 ppmvd carbon monoxide (CO) at 7% O₂ dilution. The term "HCl-equivalent" refers to emissions of both HCl and chlorine (Cl₂). The Cl₂ emissions must be converted to HCl-equivalent emissions for comparison to the allowed emission rate. The emission limits when burning wood-based fuels are 0.39 lb/MMBtu- PM; 5.0E-06 lb/MMBtu-Hg; 435.5 lb/hr HCl-eq.; and 834 ppmvd CO at 7% O₂. The limits when burning No.2 fuel oil are 0.014 lb/MMBtu- PM; 3.0E-06 lb/MMBtu-Hg; and 30 ppmvd CO at 7% O₂. The only limit when burning natural gas is 66 ppmvd CO at 7% O₂. When mixtures of two or more fuels are cofired, the allowed emissions are prorated based on the proportion of each fuel burned, in compliance with the equation in Section 2.1.A.4.b.2. of the Title V air permit. Per item 2.1.A.4.c. in the Title V permit, the respective emissions limitations and the associated testing, monitoring, and recordkeeping for a particular fuel do not apply, if that fuel is fired at less than 10% of total heat input on a 12-month rolling average basis. The PM emission limits are surrogate compliance limits for total selected

hazardous metals (TSM) and no direct performance testing or emissions monitoring is required for TSM, provided compliance with the PM limits are demonstrated. Initial and annual performance tests are required for compliance demonstrations with the PM, HCl-eq., Hg, and CO emission limits.

In addition to the pollutant-specific emission limits, the 112(j) Boiler MACT also establishes operating limits that are specific to the type of control systems installed for compliance with the emission limits. Continuous compliance with these operating limits documents continuous compliance with the pollutant-specific emission limits between performance tests. Continuous compliance with the operating limits must be demonstrated by monitoring with a continuous parameter monitoring system (CPMS). The University's Title V permit specifies the parameters that should be monitored for each type of installed emissions control system. Continuous compliance with the PM emission limit for baghouse-controlled boilers can be demonstrated by either (1) bag leak detection monitoring or (2) continuous opacity monitoring with a COMS to demonstrate compliance with a surrogate visible emissions operating limit. The bag leak detection alternative operating limit is no leak detection system alarms for more than 5% of the operating hours in any 6-month period. The alternative visible emissions operating limit is 20% opacity (6-minute average) with no more than one 6-minute average of up to 27% opacity allowed per hour.

The Title V permit specifies that continuous compliance with the mercury (Hg) emission limit, for the limestone injection/baghouse system controlled boilers, be demonstrated by compliance with both a baghouse operating limit and a sorbent (limestone) injection system operating limit. The Hg control operating limit for the boiler baghouses is the same alternative bag leak detection monitoring or visible emissions operating limits discussed above for the PM emissions limits. The Hg control operating limit for the limestone injection systems is the sorbent injection rate necessary to insure compliance with the Hg emission limit. The HCl-eq. operating limit for the limestone injection system is also the sorbent injection rate necessary to insure compliance with the HCl-eq. emission limit. The acceptable sorbent injection rate operating limit for both the Hg and HCl-eq. emission limits must be established during the performance tests. The limits are set at the limestone injection rates measured concurrently with the performance tests that demonstrate compliance with the Hg and HCl-eq. mass (lb/MMBtu and lb/hr) emission limits. The University is required to submit a permit application to DAQ (within 60-days of approval of the performance tests by DAQ) to incorporate the sorbent injection rate operating limit(s) for Hg and HCl-eq. into the permit.

The 435.5 lb/hr 112(j) HCl-eq. emissions limit in the Title V permit is a health-based compliance alternative (HBCA) standard. The limit represents a facility-wide total mass emissions limit (lbs/hr) for HCl-eq. from all 112(j) regulated boilers on the campus. The allowed HBCA mass emission rate (lb/hr) is dependent on a facility's affected boiler stack discharge heights and the distances from the stacks to the closest property boundary. There are currently six (6) on campus boilers at the University subject to the 112(j) Boiler MACT emission limits. These units include Boiler Nos. 6, 7, and 8 at the Cogeneration Facility, Boilers Nos. 9 and 10 at the Manning Drive Steam Plant, and a small (2.52 MMBtu/hr) natural gas-fired boiler (ES-SB6) located at Davie Hall. However, Boiler Nos. 8, 9 and 10 are all natural gas and No.2 oil-fired units, and the small boiler at Davie Hall is a natural gas-fired unit. The DAQ emission factors for natural gas and

distillate oil do not contain any factors for HCl, which indicates no significant HCl-eq. emissions when burning these fuels. This is confirmed by the DAQ's 112(j) Boiler MACT model rule HCl-eq. limits which are only applicable to wood and coal combustion. As specified in the University's Title V air permit, the 435.5 lb/hr facility-wide HCl-eq. limit is applicable only to Boiler Nos. 6 and 7. In compliance with the Title V permit, 112(j) HCl-eq. and Hg performance tests on Boiler Nos. 6 & 7 were performed in July 2013, March 2014, and December 2014. The results of this testing and the proposed limestone injection rate operating limits for Boiler Nos. 6 and 7 from this testing are discussed later in this application.

The DAQ's 112(j) Boiler MACT model rule guidance issued in 2009 only indicates a carbon monoxide (CO) CEMS continuous compliance monitoring option for the CO emissions limits for boilers >100 MMBtu/hr in size. However, the EPA's January 31, 2013 final revisions to the federal Boiler MACT (§63.7525) include both a (1) CO CEMS and (2) O₂ analyzer system, as compliance monitoring alternatives for the CO emission limits subject to continuous emissions monitoring requirements. At the University's request, the University's Title V air permit [§2.1.A.4.1.] was modified in March 2013 to also allow the use of monitoring of O₂ concentrations as a surrogate compliance indicator for the 112(j) Boiler MACT CO limits. The federal Boiler MACT (§63.7575) defines an O₂ analyzer system as all equipment required to determine the oxygen content of a gas stream and used to monitor oxygen in the boiler flue gas or firebox. This definition includes oxygen trim systems installed, calibrated, maintained, and operated in accordance with manufacturer recommendations. An oxygen trim system is defined (§63.7575) as a system of monitors that is used to maintain excess air at the desired level in a combustion device, with a typical system automatically providing a feedback signal to the combustion air controller. As promulgated by EPA in the federal Boiler MACT [§63.7525(a)(2)], the surrogate O₂ operating limit must be set at the minimum percent oxygen by volume (ppmv) that is established during CO emission limit performance test(s). The O₂ operating limit must be based on the lowest hourly average oxygen concentration measured (lowest of three 1-hr test runs) during the most recent CO performance test. The University is required to submit a permit application within 60-days of approval of the performance tests by DAQ to incorporate the O₂ operating limit(s) into the permit. In compliance with the Title V permit, 112(j) CO performance tests on Boiler Nos. 6 and 7 were completed in July 2013 and December 2014. The results of the CO emissions testing and the proposed O₂ trim concentration operating limits for Boiler Nos. 6 and 7 are discussed in the following sections of this application.

V. Boiler Nos. 6 and 7 July 9-10, 2013 Performance Test Results

Initial 112(j) performance tests were conducted on Boiler Nos. 6 and 7 on July 9-10, 2013. Attachment A presents summary tables of the results of the initial performance tests. The test results are discussed below.

Boiler Operation During July 2013 Tests – Boiler Nos. 6 and 7 are identical circulating fluidized-bed combustion units (CFBC) permitted for the firing of coal, No.2 fuel oil, natural gas, and wood-based fuels. Because of the fluidized-bed design and efficiency considerations, the units are usually operated entirely on coal or co-fired with coal and one of the other three

fuels. In accordance with the Title V air permit (§2.1.A.4.g.), the initial 112(j) performance tests were conducted while firing only coal in both boilers.

The maximum rated steam output of both boilers at 100% capacity utilization is 250,000 lbs/steam/hr. Performance testing for demonstration of compliance with emission limits under most air quality regulatory programs is generally conducted at >90% of maximum rated capacity (i.e. >225,000 lb/steam/hr). However, a turbine breakdown prior to the scheduled 112(j) initial performance testing on July 9-10, 2013 limited average boiler steam loads during the tests to 144,101 and 138,097 lbs/steam/hr, respectively. These operating rates represent 57.6% and 55.2% of the maximum rated steam load, respectively. Because of the mandatory initial performance testing within 180-days of the effective date of the 112(j) regulation (2/3/13), the University proceeded with the scheduled initial performance tests despite the turbine breakdown. Although initial performance tests under most programs are generally conducted at >90% of rated capacity, the federal Boiler MACT [63.7520(c)] specifies that boilers be tested at “representative operating load conditions” during performance tests. The DAQ’s 112(j) model rule (Section 6.c.) further states that performance tests be conducted at the “maximum normal operating load”. Attachment B presents operating load range analyses for Boiler Nos.6 and 7 for calendar years 2013 and 2014. As shown in Attachment B, Boiler No. 6 steam loads during calendar years 2013 and 2014 were 70,000-124,000 lbs/steam/hr for 58.6 and 62.3% of the total operating hours, 124,000-178,000 lbs/steam/hr for 32.3 and 24.0% of the operating hours, and 178,000-250,000 lbs/steam/hr for only 9.1 and 13.7% of the operating hours. Boiler No. 7 operating loads during 2013 and 2014 were 70,000-124,000 lbs/steam/hr for 62.3 and 53.2% of the operating hours, 124,000-178,000 lbs/steam/hr for 24.0 and 39.3% of the operating hours, and 178,000-250,000 lbs/steam/hr for only 13.7 and 7.4% of the operating hours. Based on the operational history of Boiler Nos. 6 and 7, as indicated in Attachment B, the 144,101 and 138,097 lbs/steam/hr boiler loads during the initial 112(j) performance tests on July 9-10, 2013 were “representative operating load conditions” and can be considered representative of “maximum normal operating load”. However, the federal Boiler MACT specifies that operation of boilers tested at operating loads <90% of maximum rated capacity during performance testing be restricted in the permit to the operating loads achieved during the performance testing plus an additional 10%.

Analysis Of Coal Burned During July 2013 Tests – During the July 9-10, 2013 initial 112(j) performance tests, representative coal samples were taken and analyzed for moisture content, heating value, and concentrations of chlorine, mercury, arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and selenium. Three (3) grab samples were taken at equally-spaced time intervals during each test run. These 3 grab samples were mixed to produce one (1) composite sample/test run/boiler for analysis. A total of six (6) composite samples for 3-test runs per boiler (2 boilers) were sent to the laboratory for analysis. The results of the coal analysis are summarized in Attachment C. As shown in Attachment C, the coal burned in Boiler No. 6 during the initial 112(j) performance tests had an average heating value of 12,593 Btu/lb, a moisture content of 8.43% , a chlorine content of 0.19% (1,900 ppm) , and a mercury content of 0.080 mg/kg. The coal burned in Boiler No. 7 during the initial 112(j) performance tests had an average heating value of 12,900 Btu/lb, a moisture content of 3.24% , a chlorine content of 0.19% (1,900 ppm), and a mercury content of 0.077 mg/kg. The 1,900 ppm chlorine content is a relatively high

value and is substantially higher than the chlorine contents of coals historically burned in the boilers.

Particulate Emissions July 2013 Test Results – Under the 112(j) emissions control program, filterable particulate (PM) emission limits for the regulated fuels serve as surrogate compliance limits for the regulated solid metal HAP pollutants. The 112(j) Boiler MACT surrogate PM emission limit for Boiler Nos. 6 and 7 when burning coal is 0.08 lb/MMBtu. During the July 9-10, 2013 initial 112(j) performance tests, the Boiler No. 6 average PM emission rate was 0.00253 lb/MMBtu relative to the 0.08 lb/MMBtu limit. The Boiler No. 6 measured PM emission rate indicates compliance at only 3.16% of the 112(j) limit. The Boiler No. 7 average PM emission rate was also 0.00253 lb/MMBtu relative to the 0.08 lb/MMBtu limit. The Boiler No. 7 measured PM emission rate also indicates compliance at only 3.16% of the 112(j) limit.

Mercury Emissions July 2013 Test Results – The 112(j) Boiler MACT mercury (Hg) emission limit for Boiler Nos. 6 and 7 when burning coal is 3.0E-06 lb/MMBtu. During the July 9-10, 2013 initial 112(j) performance test, the Boiler No. 6 average Hg emission rate was 4.90E-08 lb/MMBtu relative to the 3.0E-06 lb/MMBtu limit. The Boiler No. 6 measured Hg emission rate indicates compliance at only 1.63% of the 112(j) limit. The Boiler No. 7 average Hg emission rate was 5.52E-08 lb/MMBtu relative to the 3.0E-06 lb/MMBtu limit. The Boiler No. 7 measured Hg emission rate indicates compliance at only 1.84% of the 112(j) limit.

The DAQ's 112(j) Boiler MACT model rule and the University's Title V air permit require control device operating limits to be monitored for continuous compliance demonstrations. Continuous compliance with these operating limits documents continuous compliance with the pollutant-specific emission limits between annual performance testing events. Continuous compliance with the operating limits is demonstrated by monitoring control device or boiler operation with appropriate continuous parameter monitoring systems (CPMS). The DAQ's 112(j) Boiler MACT model rule and the Title V air permit specify the parameters that should be monitored by the CPMS for each type of installed emissions control system. In the case of Boiler Nos. 6 and 7, Hg emissions are controlled by a limestone sorbent injection/baghouse control system. The Hg operating limits are (1) 20% opacity from the baghouses as monitored by the boiler COMS and (2) the acceptable sorbent injection rate established during Hg performance tests. The Title V air permit specifies that the format of the limestone injection rate operating limit be a maximum fuel (coal and or wood) feed rate to sorbent feed rate ratio (lbs/lb). The maximum fuel to sorbent ratio operating limit is a 3-hr. block average limit established at the average fuel to sorbent ratio measured during the performance test documenting compliance with the Hg mass (lb/MMBtu) emission limit. The operating limit parameters measured during the July 2013 tests are presented in Attachment D. The Boiler No. 6 average coal to limestone (sorbent) ratio during the Hg performance test on July 9, 2013 was 11.14 lbs/lb. The Boiler No. 7 average coal to limestone ratio during the Hg performance test on July 10, 2013 was 10.79 lbs/lb.

Hydrogen Chloride Equivalent Emissions July 2013 Test Results – The 112(j) Boiler MACT hydrogen chloride (HCl) emission limit for Boiler Nos. 6 and 7 is 435.5 lbs/hr total HCl-equivalent emissions from both boilers. Since Boiler Nos. 6 and 7 are two identical boilers that share a common stack, the total 435.5 lb/hr HCl-equivalent limit is equal to a 217.75 lb/hr emission rate from each of the two boilers. The term "HCl-equivalent" refers to emissions of both HCl and chlorine (Cl₂). The Cl₂ emissions must be converted to HCl-equivalent emissions

for comparison to the allowed emission rate. The Cl_2 conversion to HCl-equivalents is based on the toxicity of Cl_2 relative to the toxicity of HCl. Based on the respective toxicity reference values for Cl_2 and HCl, 1.0 lb/hr of Cl_2 is equal to 100 lb/hr of HCl-equivalents. During the July 9-10, 2013 initial 112(j) performance test, the Boiler No. 6 average HCl emission rate was 26.5 lbs/hr and the Cl_2 emission rate was $3.64\text{E-}02$ lb/hr at the 144,101 lbs/steam/hr boiler load rate during the test. The Boiler No. 7 average HCl emission rate was 21.7 lbs/hr and the Cl_2 emission rate was $4.26\text{E-}02$ lb/hr at the 138,097 lbs/steam/hr boiler load rate during the test. Calculations are presented with the D5 Form in this application that present the total combined HCl-equivalent emission rate from both boilers at the maximum rated capacity of both boilers based on the measured HCl and chlorine emissions during the July 9-10, 2013 performance tests. The calculated total combined HCl-eq. emission rate from both boilers at the 100% steam load rating is 99.29 lb/hr relative to the 435.5 lb/hr limit. The calculated maximum 99.29 lb/hr HCl-eq. emission rate from both boilers at 100% load capacity indicates compliance at only 22.8% of the 112(j) limit. It should be noted that these values are representative worst case values associated with the 1,900 ppm historically high chlorine content coals burned during the tests.

As noted above, the DAQ's 112(j) Boiler MACT model rule and the University's Title V air permit require control device operating limits to be monitored for continuous compliance demonstrations. HCl-eq. emissions are controlled by the sorbent (limestone) injection systems on each boiler. The HCl-eq. operating limit for sorbent injection systems is the minimum acceptable sorbent injection rate established during the HCl-eq. performance tests. The Title V air permit specifies that the format of the limestone injection rate operating limit be a maximum fuel (coal and/or wood) feed rate to sorbent feed rate ratio (lbs/lb). The maximum fuel to sorbent ratio operating limit for HCl-eq. emission limit compliance monitoring is a 3-hr. block average limit established at the average fuel to sorbent ratio measured during the performance test documenting compliance with the HCl-eq. mass (lb/hr) emission limit. The operating limit parameters measured during the July 2013 tests are presented in Attachment D. The Boiler No. 6 average coal to limestone (sorbent) ratio during the HCl and Cl_2 performance test on July 9, 2013 was 11.08 lbs/lb. The Boiler No. 7 average coal to limestone ratio during the HCl and Cl_2 test on July 10, 2013 was 10.79 lbs/lb.

Carbon Monoxide (CO) Emissions July 2013 Test Results – Carbon monoxide (CO) is not a regulated hazardous air pollutant (HAP) directly subject to the 112(j) MACT regulations. The 112(j) Boiler MACT CO limits for the various fuel types represent work practice standards that serve to insure good boiler combustion control, and are surrogate performance indicators for the control of organic HAPs that can result from incomplete combustion of carbon-based fuels. The 112(j) Boiler MACT work practice CO limit for Boiler Nos. 6 and 7 when burning coal is 133 ppmvd at 7% O_2 . During the July 9-10, 2013 initial 112(j) performance test, the Boiler No. 6 average CO emission rate was 57.86 ppmvd at 7% O_2 relative to the 133 ppmvd limit. The Boiler No. 6 measured CO emission rate indicates compliance at 43.50% of the 112(j) limit. The Boiler No. 7 average CO emission rate was 57.63 ppmvd at 7% O_2 relative to the 133 ppmvd limit. The Boiler No. 7 measured CO emission rate indicates compliance at 43.33% of the 112(j) limit.

The DAQ's 112(j) Boiler MACT model rule and the federal Boiler MACT provisions require a continuous monitoring system on boilers 100 MMBtu/hr or larger in size to document continuous compliance with the work practice CO limits. The University's Title V air permit

allows the use of either a CO CEMS for direct measurement of CO concentrations or monitoring of O₂ trim concentrations as a surrogate compliance indicator for the CO limits. The surrogate O₂ operating limit must be set at the minimum percent oxygen by volume (ppmv) that is established during CO performance tests. The minimum percent O₂ by volume is the lowest hourly average O₂ concentration measured (lowest of three 1-hr test runs) during the most recent CO performance test. The O₂ operating limit is a 30-day rolling average limit that is calculated each day. As allowed by the Title V air permit, the University has selected the surrogate O₂ concentration monitoring option, with the existing O₂ trim system, in lieu of installing CO CEMS. The Boiler No. 6 average O₂ concentrations for each of the 3-test runs during the CO performance test on July 9, 2013 were, 6.56, 6.83, and 6.88%, respectively. The Boiler No. 7 average O₂ concentrations for each of the 3-test runs during the CO performance test on July 10, 2013 were 8.89, 9.09, and 9.08%, respectively.

VI. Boiler Nos. 6 and 7 March 4-5, 2014 Performance Test Results

As noted earlier, Boiler Nos. 6 and 7 steam loads during the July 9-10, 2013 initial 112(j) performance tests were only 57.6% and 55.2% of the maximum rated load, respectively. A second round of 112(j) performance tests were conducted on Boiler Nos. 6 and 7 on March 4-5, 2014 with both units operating at >90% of maximum rated steam load. Attachment E presents summary tables of the results of the March 4-5, 2014 performance tests. The test results are discussed below.

Boiler Operation During March 2014 Tests – The maximum rated energy (steam) output of both boilers at 100% capacity utilization is 250,000 lbs/steam/hr. Average boiler steam loads for Boiler Nos. 6 and 7 during the March 2014 tests were 232,152 and 233,134 lbs/steam/hr, respectively. These operating rates represent 92.9% and 93.3% of the maximum rated steam load, respectively.

Analysis Of Coal Burned During March 2014 Tests – During the March 4-5, 2014 112(j) performance tests, representative coal samples were taken and analyzed for moisture content, heating value, and concentrations of chlorine, mercury, arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and selenium. The results of the coal analysis are summarized in Attachment F. As shown in Attachment F, the coal burned in Boiler No. 6 during the March 4-5, 2014 performance tests had an average heating value of 13,153 Btu/lb, a moisture content of 4.13% , a chlorine content of 867 ppm, and a mercury content of 0.137 mg/kg. The coal burned in Boiler No. 7 had an average heating value of 13,153 Btu/lb, a moisture content of 4.48%, a chlorine content of 600 ppm, and a mercury content of 0.133 mg/kg. The 600-867 ppm chlorine contents are typical values and are substantially lower than the chlorine content (1,900 ppm) of the coals burned in the boilers during the initial July 9-10, 2013 performance tests. In contrast, the 0.133–0.137 mg/kg mercury contents are almost twice as high as the mercury contents of the coals burned in the boilers during the initial July 9-10, 2013 performance tests.

Particulate Emissions March 2014 Test Results – The 112(j) Boiler MACT surrogate PM emission limit for Boiler Nos. 6 and 7 when burning coal is 0.08 lb/MMBtu. During the March 4-5, 2014 performance tests, the Boiler No. 6 average PM emission rate was 0.00495 lb/MMBtu relative to the 0.08 lb/MMBtu limit. The Boiler No. 6 measured PM emission rate indicates

compliance at only 6.19% of the 112(j) limit. The Boiler No. 7 average PM emission rate was 0.0125 lb/MMBtu relative to the 0.08 lb/MMBtu limit. The Boiler No. 7 measured PM emission rate indicates compliance at 15.6% of the 112(j) limit.

Mercury Emissions March 2014 Test Results – The 112(j) Boiler MACT mercury (Hg) emission limit for Boiler Nos. 6 and 7 when burning coal is 3.0E-06 lb/MMBtu. During the March 4-5, 2014 performance tests, the Boiler No. 6 average Hg emission rate was 1.72E-07 lb/MMBtu relative to the 3.0E-06 lb/MMBtu limit. The Boiler No. 6 measured Hg emission rate indicates compliance at only 5.73% of the 112(j) limit. The Boiler No. 7 average Hg emission rate was 1.61E-07 lb/MMBtu relative to the 3.0E-06 lb/MMBtu limit. The Boiler No. 7 measured Hg emission rate indicates compliance at only 5.37% of the 112(j) limit. The operating limit parameters measured during the March 2014 tests are presented in Attachment G. The Boiler No. 6 average coal to limestone (sorbent) ratio during the Hg performance test on March 4, 2014 was 8.95 lbs/lb. The Boiler No. 7 average coal to limestone ratio during the Hg performance test on March 5, 2014 was 9.53 lbs/lb.

Hydrogen Chloride Equivalent Emissions March 2014 Test Results – The 112(j) Boiler MACT hydrogen chloride equivalent (HCl-eq.) emission limit for Boiler Nos. 6 and 7 is 435.5 lbs/hr total HCl-eq. emissions from both boilers. During the March 2014 performance tests, the Boiler No. 6 average HCl emission rate was 15.5 lbs/hr and the Cl₂ emission rate was 2.90E-02 lb/hr at the 232,152 lbs/steam/hr boiler load rate during the test. The Boiler No. 7 average HCl emission rate was 13.7 lbs/hr and the Cl₂ emission rate was 1.85E-02 lb/hr at the 233,134 lbs/steam/hr boiler load rate during the test. Calculations are presented with the D5 Form in this application that present the total combined HCl-equivalent emission rate from both boilers at the maximum rated steam output of both boilers based on the measured HCl and chlorine emissions during the March 4-5, 2014 performance tests. The calculated total combined HCl-eq. emission rate from both boilers at the 100% steam load capacity is 36.49 lb/hr relative to the 435.5 lb/hr limit. The calculated maximum 36.49 lb/hr HCl-equivalent rate from both boilers at the 100% steam load capacity indicates compliance at only 8.4% of the 112(j) limit. It should be noted that these values are associated with 600-867 ppm moderate chlorine content coals and are significantly lower than the worst case values associated with the 1,900 ppm historically high chlorine content coals burned during the July 9-10, 2013 initial performance test.

The operating limit parameters measured during the March 2014 tests are presented in Attachment G. The Boiler No. 6 average coal to limestone (sorbent) ratio during the HCl and Cl₂ performance test on March 4, 2014 was 9.00 lbs/lb. The Boiler No. 7 average coal to limestone ratio during the HCl and Cl₂ test on March 5, 2014 was 9.53 lbs/lb.

Carbon Monoxide (CO) Emissions March 2014 Test Results – During the March 4-5, 2014 performance tests, CO concentrations were measured and reviewed on the monitor screen. However, it was later discovered that the testing contractor had failed to record the measured CO data in their database. Although the corresponding CO emissions data was not recorded, operating data recorded during the performance tests indicated an average O₂ trim concentration of 4.02% at the 92.9% steam load for Boiler No.6 and 4.61% at the 93.3% steam load for Boiler No.7.

VII. Boiler Nos. 6 and 7 December 17-18, 2014 Performance Test Results

As noted earlier, the Boiler Nos. 6 and 7 operating loads during the July 9-10, 2013 initial 112(j) performance tests were only 57.6% and 55.2% of the maximum rated steam load. As a result, a second round of testing was performed on March 4-5, 2014 with both units operating at >90% load. However, CO performance tests were not satisfactorily completed during the second round of performance tests due to a mistake by the testing contractor. CO performance tests at >90% operating load conditions are an absolute necessity to set acceptable oxygen trim operating limits for continuous compliance monitoring for the CO emission limits. A third round of performance tests for all 112(j) pollutants, including CO, were conducted on Boiler Nos. 6 and 7 on December 17-18, 2014 with both units operating at >90% maximum rated steam load. Attachment H presents summary tables of the results of the December 16-17 performance tests. The test results are discussed below.

Boiler Operation During December 2014 Tests – The maximum rated steam output of both boilers at 100% capacity utilization is 250,000 lbs/steam/hr. Average boiler steam loads for Boiler Nos. 6 and 7 during the December 17-18, 2014 tests were 231,696 and 231,731 lbs/steam/hr, respectively. These operating rates represent 92.68% and 92.69% of the maximum rated load, respectively.

Analysis Of Coal Burned During December Tests – During the December 17-18, 2014 performance tests, representative coal samples were taken and analyzed for moisture content, heating value, and concentrations of chlorine, mercury, arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and selenium. The results of the coal analysis are summarized in Attachment I. As shown in Attachment I, the coal burned in Boiler No. 6 during the December 17-18, 2014 performance tests had an average heating value of 12,148 Btu/lb, a moisture content of 8.20% , a chlorine content of 1,077 ppm, and a mercury content of 0.19 ppm (mg/kg). The coal burned in Boiler No. 7 had an average heating value of 11,476 Btu/lb, a moisture content of 8.29% , a chlorine content of 730 ppm, and a mercury content of 0.18 ppm (mg/kg). The 730-1,077 ppm chlorine contents are moderate values and are substantially lower than the chlorine content (1,900 ppm) of the coals burned in the boilers during the initial July 9-10, 2013 performance tests. In contrast, the 0.18–0.19 mg/kg mercury contents are over twice as high as the mercury contents (0.077-0.080 mg/kg) of the coals burned in the boilers during the initial July 9-10, 2013 performance tests.

Particulate Emissions December 2014 Test Results – The 112(j) Boiler MACT surrogate PM emission limit for Boiler Nos. 6 and 7 when burning coal is 0.08 lb/MMBtu. During the December 17-18, 2014 performance tests, the Boiler No. 6 average PM emission rate was 0.00215 lb/MMBtu relative to the 0.08 lb/MMBtu limit. The Boiler No. 6 measured PM emission rate indicates compliance at only 2.69% of the 112(j) limit. The Boiler No. 7 average PM emission rate was 0.00727 lb/MMBtu relative to the 0.08 lb/MMBtu limit. The Boiler No. 7 measured PM emission rate indicates compliance at only 9.09% of the 112(j) limit.

Mercury Emissions December 2014 Test Results – The 112(j) Boiler MACT mercury (Hg) emission limit for Boiler Nos. 6 and 7 when burning coal is 3.0E-06 lb/MMBtu. During the December 17-18, 2014 performance tests, the Boiler No. 6 average Hg emission rate was 1.73E-

07 lb/MMBtu relative to the 3.0E-06 lb/MMBtu limit. The Boiler No. 6 measured Hg emission rate indicates compliance at only 5.77% of the 112(j) limit. The Boiler No. 7 average Hg emission rate was 1.75E-07 lb/MMBtu relative to the 3.0E-06 lb/MMBtu limit. The Boiler No. 7 measured Hg emission rate indicates compliance at only 5.83% of the 112(j) limit. The operating limit parameters measured during the December 2014 tests are presented in Attachment J. The Boiler No. 6 average coal to limestone (sorbent) ratio during the Hg performance test on December 17, 2014 was 8.57 lbs/lb. The Boiler No. 7 average coal to limestone ratio during the Hg performance test on December 18, 2014 was 8.54 lbs/lb.

Hydrogen Chloride Equivalent Emissions December 2014 Test Results – The 112(j) Boiler MACT hydrogen chloride equivalent (HCl-eq.) emission limit for Boiler Nos. 6 and 7 is 435.5 lbs/hr total HCl-eq. emissions from both boilers. During the December 17-18, 2014 performance tests, the Boiler No. 6 average HCl emission rate was 22.9 lbs/hr and the Cl₂ emission rate was 7.29E-06 lb/hr at the 231,696 lbs/steam/hr boiler load rate during the test. The Boiler No. 7 average HCl emission rate was 19.9 lbs/hr and the Cl₂ emission rate was 5.70E-06 lb/hr at the 231,731 lbs/steam/hr boiler load rate during the test. Calculations are presented with the D5 Form in this application that present the total combined HCl-eq. emission rate from both boilers at the maximum rated steam load of both boilers, based on the measured HCl and chlorine emissions during the December 17-18, 2014 performance tests. The calculated total combined HCl-eq. emission rate from both boilers at the 100% maximum rated steam load is 46.18 lb/hr relative to the 435.5 lb/hr limit. The calculated maximum 46.18 lb/hr HCl-equivalent rate from both boilers at the 100% steam load capacity indicates compliance at only 10.60% of the 112(j) limit. It should be noted that the calculated maximum HCl-equivalent emission rate is associated with the 730-1,077 ppm moderate chlorine content coals burned during the tests, and is only approximately 46.5% of the 99.29 lb/hr emission rate associated with the 1,900 ppm historically high chlorine content coals burned during the July 9-10, 2013 initial performance test. The operating limit parameters measured during the December 2014 tests are presented in Attachment J. The Boiler No. 6 average coal to limestone (sorbent) ratio during the HCl and Cl₂ performance test on December 17, 2014 was 8.57 lbs/lb. The Boiler No. 7 average coal to limestone ratio during the HCl and Cl₂ test on December 18, 2014 was 8.54 lbs/lb.

Carbon Monoxide (CO) Emissions December 2014 Test Results – The 112(j) work practice CO limit for Boiler Nos. 6 and 7 when burning coal is 133 ppmvd at 7% O₂. During the December 17-18, 2014 performance tests, the Boiler No. 6 average CO emission rate was 24.66 ppmvd at 7% O₂ relative to the 133 ppmvd limit. The Boiler No. 6 measured CO emission rate indicates compliance at 18.5% of the 112(j) limit. The Boiler No. 7 average CO emission rate was 20.72 ppmvd at 7% O₂ relative to the 133 ppmvd limit. The Boiler No. 7 measured CO emission rate indicates compliance at 15.6% of the 112(j) limit.

The operating limit parameters measured during the December 2014 tests are presented in Attachment J. The Boiler No. 6 average O₂ trim concentrations for each of the 3-test runs during the CO performance test on December 17, 2014 were 4.34, 4.32, and 4.30%, respectively (4.32% avg.). The Boiler No. 7 average O₂ concentrations for each of the 3-test runs during the CO performance test on December 18, 2014 were 4.41, 3.91, and 3.73%, respectively (4.02% avg.).

VIII. Proposed Operating Limits for Boiler Nos. 6 and 7

The University's Title V permit already establishes a 20% opacity operating limit for 112(j) particulate and Hg emissions control by the baghouses. The University is required to establish operating limits for limestone injection and O₂ trim as surrogate continuous compliance monitoring parameters for Hg, HCl-equivalent, and CO based on measured values during the 112(j) performance tests. Tables 1 and 2 (pages 17 & 18) present the proposed limestone injection and O₂ trim operating limits for continuous compliance monitoring for Hg, HCl-equivalent, and CO 112(j) emission limits. The proposed operating limits based on the July 9-10, 2013, March 4-5, 2014, and December 16-17, 2014 performance tests are discussed here.

VIII.1. Proposed Mercury (Hg) Operating Limits – The 112(j) mercury (Hg) emission limits are applicable to coal, wood, and No.2 fuel oil-firing. However, no performance testing or monitoring is required for compliance demonstrations with the No.2 fuel oil emission limits. Hg emissions from Boiler Nos. 6 and 7 are controlled by limestone sorbent injection into the boiler furnaces with solid particle collection by the baghouses on the boiler exhausts. When burning coal or wood, Boiler Nos. 6 and 7 must demonstrate compliance through initial and annual performance tests, and continuous compliance between performance tests by monitoring of sorbent (limestone) injection rates and either baghouse bag leaks or stack opacity. The applicable baghouse opacity operating limit is 20% opacity (6-minute average) with no more than one 6-minute average of up to 27% opacity allowed per hour.

During the initial 112(j) performance tests on July 9-10, 2013, the Boiler Nos. 6 and 7 Hg emission rates were only 4.90E-08 and 5.52E-08 lb/MMBtu, respectively, relative to the 3.0E-06 lb/MMBtu limit for coal-firing. These emission rates are equivalent to only 1.63 and 1.84% of the emission limit, respectively. The associated average Hg contents of the coals burned during the tests were 0.080 and 0.077 mg/kg, respectively. The coal to limestone injection rate ratios into Boiler Nos. 6 and 7 during the Hg performance tests were 11.14 and 10.79 lb/lb, respectively. Therefore, compliance at only 1.63-1.84% of the applicable Hg limit was demonstrated during the July 9-10, 2014 performance tests at coal to limestone feed rate ratios of 10.79 to 11.14 lb/lb.

During the 112(j) performance tests on March 4-5, 2014, the Boiler Nos. 6 and 7 Hg emission rates were 1.72E-07 and 1.61E-07 lb/MMBtu, respectively, relative to the 3.0E-06 lb/MMBtu limit for coal-firing. These emission rates are equivalent to only 5.73 and 5.37% of the emission limit, respectively. The associated average Hg contents of the coals burned during the tests were 0.137 and 0.133 mg/kg, respectively. The coal to limestone injection rate ratios into Boiler Nos. 6 and 7 during the Hg performance tests were 8.95 and 9.53 lb/lb, respectively. Therefore, compliance at only 5.37-5.73% of the applicable Hg limit was demonstrated during the March 4-5, 2014 performance tests at coal to limestone feed rate ratios of 8.95 to 9.53 lb/lb.

During the 112(j) performance tests on December 17-18, 2014, the Boiler Nos. 6 and 7 Hg emission rates were 1.73E-07 and 1.75E-07 lb/MMBtu, respectively, relative to the 3.0E-06 lb/MMBtu limit for coal-firing. These emission rates are equivalent to only 5.77 and 5.83% of the emission limit, respectively. The associated average Hg contents of the coals burned during the tests were 0.19 and 0.18 mg/kg, respectively. The coal to limestone injection rate ratios into

Boiler Nos. 6 and 7 during the Hg performance tests were 8.57 and 8.54 lb/lb, respectively. Therefore, compliance at only 5.77-5.83% of the applicable Hg limit was demonstrated during the December 17-18, 2014 performance tests at coal to limestone feed rate ratios of 8.57 and 8.54 lb/lb.

As shown above, the highest measured Hg emission rate during all three (3) performance tests on the two identical boilers (total six tests) is only 5.83% of the Hg emission limit. The University proposes to base the Hg control sorbent injection rate operating limit on the highest coal to sorbent feed rate ratio at which compliance was demonstrated during the three (3) performance tests discussed above. Since Boiler Nos. 6 and 7 are identical units, the University proposes a maximum 11.0 lb/lb coal/wood to limestone feed rate ratio as the limestone injection Hg operating limit for both boilers based on the value (11.14 lb/lb) from the July 9, 2013 Hg performance test on Boiler No.6.

VIII.2. Proposed Hydrogen Chloride Equivalent (HCl-Eq.) Operating Limits – The 112(j) HCl-equivalent (HCl-eq.) emission limit is only applicable to coal and wood-firing. HCl emissions from Boiler Nos. 6 and 7 are controlled by sorbent (limestone) injection into the boiler furnaces. When burning coal or wood, compliance with the HCl-eq. emission limit for Boiler Nos. 6 and 7 must be demonstrated between performance tests by continuous monitoring of sorbent (limestone) injection rates. The University's Title V air permit requires that HCl-eq. performance tests be conducted while burning coal only. The 112(j) HCl-eq. emission limit for Boiler Nos. 6 and 7 is 435.5 lbs/hr total HCl-eq. emissions from both boilers. The term "HCl-equivalent" refers to emissions of both HCl and chlorine (Cl₂). The Cl₂ emissions must be converted to HCl-equivalent emissions for comparison to the allowed emission rate.

During the initial 112(j) performance tests on July 9-10, 2013, the Boiler Nos. 6 and 7 combined HCl-eq. emission rate, with the 1,900 ppm chlorine content coals burned, was 56.10 lb/hr, at the 55-58% boiler operating steam loads during the tests. Calculations presented with the D5 form in this application show that the corresponding maximum combined potential HCl-equivalent emission rate from both boilers, at the 100% maximum rated steam load, is only 99.29 lb/hr relative to the 435.5 lb/hr limit. The coal to limestone injection rate ratios into Boiler Nos. 6 and 7 during the initial July 9-10, 2013 HCl and Cl₂ performance tests were 11.08 and 10.79 lb/lb, respectively.

During the follow up performance tests on March 4-5, 2014, the Boiler Nos. 6 and 7 combined HCl-eq. emission rate, with the 600-867 ppm chlorine content coals burned, was 33.95 lb/hr, at the 92.9-93.3% boiler operating steam loads during the tests. Calculations presented with the D5 form in this application show that the corresponding maximum combined potential HCl-eq. emission rate from both boilers, at the 100% maximum rated steam load, is only 36.49 lb/hr relative to the 435.5 lb/hr limit. The coal to limestone injection rate ratios into Boiler Nos. 6 and 7 during the March 4-5, 2014 HCl and Cl₂ performance tests were 9.00 and 9.53 lb/lb, respectively.

During the most recent performance tests on December 17-18, 2014, the Boiler Nos. 6 and 7 combined HCl-eq. emission rate, with the 730-1,077 ppm chlorine content coals burned, was 42.80 lb/hr, at the 92.7% boiler steam loads during the tests. Calculations presented with the D5

form in this application show that the corresponding maximum combined potential HCl-equivalent emission rate from both boilers, at the 100% maximum rated steam load, is only 46.18 lb/hr relative to the 435.5 lb/hr limit. The coal to limestone injection rate ratios into Boiler Nos. 6 and 7 during the December 17-18, 2014 HCl and Cl₂ performance tests were 8.57 and 8.54 lb/lb, respectively.

The highest calculated HCl-eq. emission rate during the three (3) performance tests at a projected 100% operating load on both boilers is only 99.29 lb/hr relative to the 435.5 lb/hr limit (22.8%). This projected emission rate is based on the July 9-10, 2013 emissions tests that were conducted with the highest 1,900 ppm chlorine content coals. The University is proposing to base the HCl-eq. control limestone injection operating limit on the highest coal to limestone feed rate ratio at which compliance was demonstrated during the three (3) performance tests discussed above. (Since Boiler Nos. 6 and 7 are identical units, the University proposes a maximum 11.0 lb/lb coal/wood to limestone feed rate ratio operating limit for both boilers based on the value (11.08 lb/lb) from the July 9, 2013 performance test on Boiler No.6.)

VIII.3. Proposed Carbon Monoxide (CO) Operating Limits – The 112(j) carbon monoxide (CO) emission limits are applicable to coal, wood, No.2 fuel oil, and natural gas-firing. However, no performance testing or monitoring is required for demonstrations of compliance with the No.2 fuel oil and natural gas CO emission limits. CO emissions from Boiler Nos. 6 and 7 are limited by good boiler combustion control and are generally inversely proportional to O₂ concentrations. When burning coal or wood, Boiler Nos. 6 and 7 must demonstrate continuous compliance between performance tests by monitoring of CO concentrations with a CO CEMS or surrogate O₂ concentrations with an O₂ trim monitoring system. The University has chosen to demonstrate continuous compliance with the CO emission limits by monitoring of the surrogate O₂ trim concentration operating limit.

Since CO is a product of incomplete combustion, maintenance of good combustion control and low CO emissions at low boiler load conditions typically requires higher excess air rates and higher corresponding O₂ trim concentrations relative to those at higher boiler load conditions. Manufacturer specifications for Boiler Nos. 6 and 7 indicate design O₂ trim concentrations that range from 3.6% at the maximum rated 250,000 lb/steam/hr capacity of the boilers up to 8.7% O₂ at 95,000 lb/steam/hr. Minimum O₂ concentration operating limits established from performance testing at reduced boiler operating loads will result in higher minimum O₂ concentration operating limits than those associated with testing at higher boiler loads. (As promulgated by EPA in the reissued federal Boiler MACT [§63.7525(a)(2)], the surrogate O₂ operating limit must be set at the minimum percent oxygen by volume that is established during CO emission limit performance test(s). The O₂ operating limit must be based on the lowest hourly average oxygen concentration measured (lowest of three 1-hr test runs during CO test). The 112(j) O₂ operating limit for Boiler Nos. 6 and 7 proposed with this application is established following this procedure.

During the July 9-10, 2013 initial 112(j) performance test, the Boiler No. 6 average CO emission rate was only 57.86 ppmvd at 7% O₂ relative to the 133 ppmvd limit. The Boiler No. 7 average CO emission rate was only 57.63 ppmvd at 7% O₂. The Boiler No. 6 average O₂ concentrations

for each of the 3-test runs during the CO performance test on July 9, 2013 were 6.56, 6.83, and 6.88%, respectively. The Boiler No. 7 average O₂ concentrations for each of the 3-test runs during the CO performance test on July 10, 2013 were 8.89, 9.09, and 9.08%. Therefore, compliance with the applicable CO limit was demonstrated during the initial performance tests at minimum O₂ concentrations of 6.56 and 8.89%, respectively. However, the boiler steam loads during the tests were only 144,101 and 138,097 lbs/steam/hr, respectively, relative to the maximum rated 250,000 lbs/steam/hr capacity of each of the two identical boilers. These operating rates represent only 57.6% and 55.2% of the maximum rated steam load, respectively.

During the March 4-5, 2014 performance tests, CO concentrations were measured. However, the measured CO data was inadvertently not recorded in the test databases. Although the corresponding CO emissions data was not recorded, operating data recorded during the performance tests indicated average O₂ trim concentrations of 4.02% at the 92.9% steam load for Boiler No.6 and 4.61% at the 93.3% steam load for Boiler No.7.

Average boiler steam loads for Boiler Nos. 6 and 7 during the December 17-18, 2014 tests were 231,696 and 231,731 lbs/steam/hr, respectively. These operating rates represent 92.68% and 92.69% of the maximum rated steam load, respectively. The Boiler No. 6 average CO emission rate was only 24.66 ppmvd at 7% O₂ relative to the 133 ppmvd limit. The Boiler No. 7 average CO emission rate was only 20.72 ppmvd at 7% O₂. The Boiler No. 6 average O₂ concentrations for each of the 3-test runs during the CO performance test on December 17, 2014 were 4.34, 4.32, and 4.30%, respectively. The Boiler No. 7 average O₂ concentrations for each of the 3-test runs during the CO performance test on December 18, 2014 were 4.41, 3.91, and 3.73%. Therefore, compliance with the applicable CO limit was demonstrated during the December 17-18, 2014 performance tests at minimum single-run O₂ concentrations of 4.30 and 3.73%, respectively. It should be noted that the lowest value is rounded from a measured 3.734%.

Based on the December 17-18, 2014 test results, the University proposes a minimum 3.74% O₂ trim concentration 30-day average operating limit for CO continuous compliance monitoring for both identical Boiler Nos. 6 and 7. It should be noted that this operating limit is consistent with manufacturer specifications for Boiler Nos. 6 and 7 that indicate design O₂ trim concentrations that range from 3.6% at the maximum rated 250,000 lb/steam/hr capacity of the boilers up to 8.7% O₂ at 95,000 lb/steam/hr.

A minimum 3.74% O₂ trim concentration 30-day average operating limit for CO continuous compliance monitoring must be maintained for the oxygen analyzer system.

Table 1
The University of North Carolina at Chapel Hill
Summary-Proposed Fuel:Limestone Ratio Operating Limit
For Mercury and HCl-Equivalent Control

Proposed Operating Limit – Maximum 11.0 lb Fuel (coal/wood)/lb Limestone

Basis for Proposed Limit

Mercury (Hg) Tests

Test Date	Unit	Boiler Operating Load, %	Fuel	Average Hg Content, mg/kg	Hg Limit, lb/MMBtu	Average Hg Emissions, lb/MMBtu	Fraction of Limit, %	Coal:Limestone Ratio, lb/lb
7/9/13	B6	57.6	Coal	0.080	3.0E-06	4.90E-08	1.63	11.14
7/10/13	B7	55.2	Coal	0.077	3.0E-06	5.52E-08	1.84	10.79
4/4/14	B6	92.9	Coal	0.137	3.0E-06	1.72E-07	5.73	8.95
4/5/14	B7	93.3	Coal	0.133	3.0E-06	1.61E-07	5.37	9.53
12/17/14	B6	92.7	Coal	0.19	3.0E-06	1.73E-07	5.77	8.57
12/18/14	B7	92.7	Coal	0.18	3.0E-06	1.75E-07	5.83	8.54

HCl-Equivalent Tests

Test Date	Unit	Boiler Operating Load, %	Fuel	Chlorine Content, ppm	Average HCl Emissions lb/hr	Average Cl ₂ Emissions lb/hr	HCl-Eq.* Emissions at Test Boiler Loads, lb/hr	HCl-Eq.* Emissions at 100% Boiler Loads, lb/hr	HCl-Eq.* Limit, lb/hr	Fraction* of Limit, %	Coal: Limestone Ratio, lb/lb
7/9/13	B6	57.6	Coal	1,900	26.5	3.64E-02	-	-	-	-	11.08
7/10/13	B7	55.2	Coal	1,900	21.7	4.26E-02	-	-	-	-	10.79
Total	B6&B7	-	-	-	48.2	7.90E-02	56.10	99.29	435.5	22.8	-
4/4/14	B6	92.9	Coal	867	15.5	2.90E-02	-	-	-	-	9.00
4/5/14	B7	93.3	Coal	600	13.7	1.85E-02	-	-	-	-	9.53
Total	B6&B7	-	-	-	29.2	4.75E-02	33.95	36.49	435.5	8.4	-
12/17/14	B6	92.7	Coal	1,077	22.9	7.29E-06	-	-	-	-	8.57
12/18/14	B7	92.7	Coal	730	19.9	5.70E-06	-	-	-	-	8.54
Total	B6&B7	-	-	-	42.8	1.30E-05	42.80	46.18	435.5	10.6	-

*The applicable 435.5 lb/hr HCl-eq. emission limit is the total allowed hourly mass emission rate from the common stack on both boilers. See calculations with Form D5 in this application.

Table 2

**The University of North Carolina at Chapel Hill
Summary-Proposed Oxygen Trim Operating Limit
For Carbon Monoxide Control**

Proposed Operating Limit – Minimum 3.74% O₂

Basis for Proposed Limit

Carbon Monoxide (CO) Tests

Test Date	Unit	Boiler Operating Load, %	Fuel	CO Limit, ppmvd*	Average CO Emissions, ppmvd*	Fraction of Limit, %	1 st Run O ₂ Trim, %	2 nd Run O ₂ Trim, %	3 rd Run O ₂ Trim, %	Average O ₂ Trim, %
7/9/13	B6	57.6	Coal	133	57.86	43.5	6.56	6.83	6.88	6.76
7/10/13	B7	55.2	Coal	133	57.63	43.3	8.89	9.09	9.08	9.02
4/4/14	B6	92.9	Coal	133	NA	NA	4.04	4.01	4.01	4.02
4/5/14	B7	93.3	Coal	133	NA	NA	4.64	4.63	4.57	4.61
12/17/14	B6	92.7	Coal	133	24.66	18.5	4.34	4.32	4.30	4.32
12/18/14	B7	92.7	Coal	133	20.72	15.6	4.41	3.91	3.734	4.02

*ppmvd at 7% O₂

The O₂ operating limit is set at the lowest hourly average oxygen trim concentration measured (lowest of three 1-hr test runs) during the CO performance tests demonstrating compliance with the CO emission limit.

FORM A1

FACILITY (General Information)

Received

MAY 08 2015

REVISED 11/01/02

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

A1

NOTE- APPLICATION WILL NOT BE PROCESSED WITHOUT THE FOLLOWING

- | | | |
|---|--|---|
| <input type="checkbox"/> Local Zoning Consistency Determination (if required) | <input checked="" type="checkbox"/> Facility Reduction & Recycling Survey Form (Form A4) | <input checked="" type="checkbox"/> Application Fee |
| <input checked="" type="checkbox"/> Responsible Official/Authorized Contact Signature | <input checked="" type="checkbox"/> Appropriate Number of Copies of Application | <input checked="" type="checkbox"/> P.E. Seal (if required) |

GENERAL INFORMATION

Legal Corporate/Owner Name: **The University of North Carolina at Chapel Hill**

Site Name: **The University of North Carolina at Chapel Hill**

Site Address (911 Address) Line 1: **302 South Building, CB#1000**

Site Address Line 2:

City: **Chapel Hill**

State: **North Carolina**

Zip Code: **27599-1000**

County: **Orange**

CONTACT INFORMATION

Permit/Technical Contact:

Name/Title: **Malachy G. Donohue/Environmental Affairs Manager**

Mailing Address Line 1: **The University of North Carolina at Chapel Hill**

Mailing Address Line 2: **1120 Estes Drive Extension, CB#1650**

City: **Chapel Hill** State: **North Carolina** Zip Code: **27599-1650**

Phone No. **(919) 962-5718**

Fax No. **(919) 962-0227**

Email Address: **mgdonohue@ehs.unc.edu**

Facility/Inspection Contact:

Name/Title: **Malachy G. Donohue/Environmental Affairs Manager**

Mailing Address Line 1: **The University of North Carolina at Chapel Hill**

Mailing Address Line 2: **1120 Estes Drive Extension, CB#1650**

City: **Chapel Hill** State: **North Carolina** Zip Code: **27599-1650**

Phone No. **(919) 962-5718**

Fax No. **(919) 962-0227**

Email Address: **mgdonohue@ehs.unc.edu**

Responsible Official/Authorized Contact:

Name/Title: **Matthew M. Fajack**

Vice Chancellor for Finance & Administration

Mailing Address Line 1: **The University of North Carolina at Chapel Hill**

Mailing Address Line 2: **302 South Building-CB#1000**

City: **Chapel Hill** State: **North Carolina** Zip Code: **27599-1000**

Phone No. **(919) 962-7234**

Fax No. **(919) 962-0647**

Email Address: **mfajack@unc.edu**

Invoice Contact:

Name/Title: **Malachy G. Donohue/Environmental Affairs Manager**

Mailing Address Line 1: **The University of North Carolina at Chapel Hill**

Mailing Address Line 2: **1120 Estes Drive Extension, CB#1650**

City: **Chapel Hill** State: **North Carolina** Zip Code: **27599-1650**

Phone No. **(919) 962-5718**

Fax No. **(919) 962-0227**

Email Address: **mgdonohue@ehs.unc.edu**

APPLICATION IS BEING MADE FOR

- | | | |
|--|---|--|
| <input type="checkbox"/> New Non-permitted Facility/Greenfield | <input type="checkbox"/> Modification of Facility (permitted) | <input type="checkbox"/> Renewal with Modification |
| | <input type="checkbox"/> Renewal (TV Only) | <input checked="" type="checkbox"/> New 112(j) Operating Limits |

FACILITY CLASSIFICATION AFTER APPLICATION (Check Only One)

- | | | | | |
|----------------------------------|--------------------------------|--|--|---|
| <input type="checkbox"/> General | <input type="checkbox"/> Small | <input type="checkbox"/> Prohibitory Small | <input type="checkbox"/> Synthetic Minor | <input checked="" type="checkbox"/> Title V |
|----------------------------------|--------------------------------|--|--|---|

FACILITY (Plant Site) INFORMATION

Describe nature of (plant site) operation(s):

Educational Institution

Primary SIC/NAICS Code: **8221/611310**

Current/Previous Air Permit No. **03069T32**

Expiration Date: **4/30/16**

Facility Coordinates: Latitude: **35° 53' 38"**

Longitude: **79° 03' 43"**

Does this application contain confidential data? ☐ YES ☒ NO

PERSON OR FIRM THAT PREPARED APPLICATION

Person Name: **Butch Smith, PE**

Firm Name: **RST Engineering, PLLC**

Mailing Address Line 1: **5416 Orchard Oriole Trail**

Mailing Address Line 2:

City: **Wake Forest**

State: **North Carolina**

Zip Code: **27587-6770**

County: **Wake**

Phone No. (area code) **(919) 810-9875** Fax No. (area code)

Email Address: **butch50@nc.rr.com**

SIGNATURE OF RESPONSIBLE OFFICIAL/AUTHORIZED CONTACT

Name (typed): **Matthew M. Fajack**

Title: **Vice Chancellor for Finance and Administration**

X Signature(Blue Ink): 

Date: **5/5/15**

Attach Additional Sheets As Necessary

FORMs A2, A3, A4
EMISSION SOURCE LISTING FOR THIS APPLICATION - A2
112r APPLICABILITY INFORMATION - A3
SURVEY OF FACILITY REDUCTION & RECYCLING ACTIVITIES - A4

REVISED 12/01/01

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

A2

EMISSION SOURCE LISTING: New, Modified, Previously Unpermitted, Replaced, Deleted			
EMISSION SOURCE ID NO.	EMISSION SOURCE DESCRIPTION	CONTROL DEVICE ID NO.	CONTROL DEVICE DESCRIPTION
Equipment To Be ADDED By This Application (New, Previously Unpermitted, or Replacement)			
None			
Existing Permitted Equipment To Be MODIFIED By This Application			
None			
Equipment To Be DELETED By This Application			
None			

112(r) APPLICABILITY INFORMATION

A 3

Is your facility subject to 40 CFR Part 68 "Prevention of Accidental Releases" - Section 112(r) of the Federal Clean Air Act? Yes / No **NO**

If No, please specify in detail how your facility avoided applicability: **No 112(r) hazardous or flammable materials stored in quantities above applicable thresholds.**

If your facility is Subject to 112(r), please complete the following: **NA**

A. Have you already submitted a Risk Management Plan (RMP) to EPA Pursuant to 40 CFR Part 68.10 or Part 68.150?
 Yes No Specify required RMP submittal date: _____ If submitted, RMP submittal date: _____

B. Are you using administrative controls to subject your facility to a lesser 112(r) program standard?
 Yes No If yes, please specify: _____

SURVEY OF FACILITY REDUCTION & RECYCLING ACTIVITIES

A 4

Facility Name: The University of North Carolina at Chapel Hill				
Mailing Address Line 1: 1120. Estes Drive Extension, CB# 1650				
City: Chapel Hill	State: North Carolina	Zip Code: 27599	County: Orange	
Phone No. (919) 962-5718	Fax No. (919) 962-0227	Email Address: mgdonohue@ehs.unc.edu		
Pollutant	Ongoing Source Reduction Activities (Enter Code)	Qty. Emitted Before Reduction (lb/yr)	Qty. Emitted After Reduction (lb/yr)	Planned Source Reduction Activities (Enter Code)
No facility reduction or recycling activities implemented with this permit application.				

For assistance with Section A4, please contact the North Carolina Division of Pollution Prevention and Environmental Assistance
 at 1-800-763-0136 or nowaste@p2pays.org
Attach Additional Sheets As Necessary

112(j) Operating Limits

Boiler Nos. 6 & 7

SPECIFIC EMISSIONS SOURCE INFORMATION (REQUIRED FOR ALL SOURCES)

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

1

TYPE OF EMISSION SOURCE (CHECK AND COMPLETE APPROPRIATE FORM B1-B9 ON THE FOLLOWING PAGES):									
<input checked="" type="checkbox"/> Coal,wood,oil, gas, other burner (Form B1)			<input type="checkbox"/> Woodworking (Form B4)			<input type="checkbox"/> Manufact. of chemicals/coatings/inks (Form B7)			
<input type="checkbox"/> Int.combustion engine/generator (Form B2)			<input type="checkbox"/> Coating/finishing/printing (Form B5)			<input type="checkbox"/> Incineration (Form B8)			
<input type="checkbox"/> Liquid storage tanks (Form B3)			<input type="checkbox"/> Storage silos/bins (Form B6)			<input type="checkbox"/> Other (Form B9)			
START CONSTRUCTION DATE: Existing			OPERATION DATE: 2/91			DATE MANUFACTURED: NA			
MANUFACTURER / MODEL NO.: Pyropower						EXPECTED OP. SCHEDULE: 24 HR/DAY 7 DAY/WK 52 WK/YR			
IS THIS SOURCE SUBJECT TO? NSPS (SUBPART?): Db			NESHAP (SUBPART?): NA			MACT (SUBPART?): 112(j)			
PERCENTAGE ANNUAL THROUGHPUT (%): DEC-FEB 25			MAR-MAY 25		JUN-AUG 25		SEP-NOV 25		
EXPECTED ANNUAL HOURS OF OPERATION: 8,760			VISIBLE STACK EMISSIONS UNDER NORMAL OPERATION: <10% % OPACITY						

CRITERIA AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

AIR POLLUTANT EMITTED	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL		POTENTIAL EMISSIONS			
		(AFTER CONTROLS / LIMITS)		(BEFORE CONTROLS / LIMITS)		(AFTER CONTROLS / LIMITS)	
		lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
PARTICULATE MATTER (PM)							
PARTICULATE MATTER<10 MICRONS (PM ₁₀)							
PARTICULATE MATTER<2.5 MICRONS (PM _{2.5})							
SULFUR DIOXIDE (SO ₂)							
NITROGEN OXIDES (NO _x)							
CARBON MONOXIDE (CO)							
VOLATILE ORGANIC COMPOUNDS (VOC)							
LEAD							
OTHER							

HAZARDOUS AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

HAZARDOUS AIR POLLUTANT AND CAS NO.	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS)		POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITS)			
		lb/hr	tons/yr	(BEFORE CONTROLS / LIMITS)		(AFTER CONTROLS / LIMITS)	
				lb/hr	tons/yr	lb/hr	tons/yr

[illegible]

Filterable PM	P. Test	-	-	-	-	2.35	10.29
Mercury	P. Test	-	-	-	-	5.66E-05	2.48E-04
Hydrogen Chloride	P. Test	-	-	-	-	39.43	172.69
Chlorine	P. Test	-	-	-	-	0.068	0.30
Carbon Monoxide	P. Test	-	-	-	-	8.53	37.37

TOXIC AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

INDICATE EXPECTED ACTUAL EMISSIONS AFTER CONTROLS / LIMITATIONS

[illegible]

COMPLETE THIS FORM AND COMPLETE AND ATTACH APPROPRIATE B1 THROUGH B9 FORM FOR EACH SOURCE
Attach Additional Sheets As Necessary

FORM B1

EMISSION SOURCE (WOOD, COAL, OIL, GAS, OTHER FUEL-FIRED BURNER)

REVISED 12/01/01

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

B1

EMISSION SOURCE DESCRIPTION: Existing Boilers #6 and #7		EMISSION SOURCE ID NO: ES-001, ES-002	
		CONTROL DEVICE ID NO(S): CD-004, 005	
OPERATING SCENARIO: 1-4 OF 1-4		EMISSION POINT (STACK) ID NO: EP 14-136	
DESCRIBE USE: PROCESS HEAT <input checked="" type="checkbox"/> SPACE HEAT <input checked="" type="checkbox"/> ELECTRICAL GENERATION <input checked="" type="checkbox"/> CONTINUOUS USE STAND BY/EMERGENCY <input checked="" type="checkbox"/> OTHER (DESCRIBE): Steam			
HEATING MECHANISM: <input checked="" type="checkbox"/> INDIRECT DIRECT			
MAX. FIRING RATE (MMBTU/HOUR): Each Boiler has a capacity of 323.17 MMBTU/hr			
WOOD-FIRED BURNER			
WOOD TYPE: BARK WOOD/BARK WET WOOD DRY WOOD <input checked="" type="checkbox"/> Other (Describe): Pellets & Torrefied			
PERCENT MOISTURE OF FUEL: 3-5%			
UNCONTROLLED CONTROLLED WITH FLYASH REINJECTION <input checked="" type="checkbox"/> CONTROLLED: Baghouse/Limestone Injection			
FUEL FEED METHOD: Circulating Fluidized-Bed HEAT TRANSFER MEDIA: <input checked="" type="checkbox"/> STEAM AIR OTHER			
METHOD OF TUBE CLEANING: Tube Blowing		CLEANING SCHEDULE: Every 8 hours	
COAL-FIRED BURNER			
TYPE OF BOILER CFBC		IF OTHER DESCRIBE:	
PULVERIZED	OVERFEED STOKER	UNDERFEED STOKER	SPREADER STOKER
<input type="checkbox"/> WET BED	UNCONTROLLED	UNCONTROLLED	UNCONTROLLED
<input type="checkbox"/> DRY BED	CONTROLLED	CONTROLLED	FLYASH REINJECTION
		NO FLYASH REINJECTION	
		FLUIDIZED BED	
		<input checked="" type="checkbox"/> CIRCULATING	
		RECIRCULATING	
METHOD OF LOADING: CYCLONE HANDFIRED TRAVELING GRATE <input checked="" type="checkbox"/> OTHER (DESCRIBE): Auger to Fluidized-Bed			
METHOD OF TUBE CLEANING: Tube Blowing		CLEANING SCHEDULE: Every 8 hours	
OIL/GAS-FIRED BURNER			
TYPE OF BOILER: <input type="checkbox"/> UTILITY <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> RESIDENTIAL <input checked="" type="checkbox"/> Institutional			
TYPE OF FIRING: <input type="checkbox"/> NORMAL <input type="checkbox"/> TANGENTIAL <input type="checkbox"/> LOW NOX BURNERS <input type="checkbox"/> NO LOW NOX BURNER			
METHOD OF TUBE CLEANING: Tube Blowing		CLEANING SCHEDULE:	
OTHER FUEL-FIRED BURNER			
TYPE OF FUEL: PERCENT MOISTURE:			
TYPE OF BOILER: <input type="checkbox"/> UTILITY <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> RESIDENTIAL			
TYPE OF FIRING:		TYPE OF CONTROL (IF ANY):	
METHOD OF TUBE CLEANING:		CLEANING SCHEDULE:	
FUEL USAGE (INCLUDE STARTUP/BACKUP FUELS)			
FUEL TYPE	UNITS	MAXIMUM DESIGN CAPACITY (UNIT/HR)	REQUESTED CAPACITY LIMITATION (UNIT/HR)
Coal	MMBtu/hr	323.17	None
No.2 Fuel Oil	MMBtu/hr	323.17	None
Natural Gas	MMBtu/hr	323.17	None
Wood-Based Fuels	MMBtu/hr	323.17	None
FUEL CHARACTERISTICS (COMPLETE ALL THAT ARE APPLICABLE)			
FUEL TYPE	SPECIFIC BTU CONTENT	SULFUR CONTENT (% BY WEIGHT)	ASH CONTENT (% BY WEIGHT)
Characteristics vary with fuel type.			
SAMPLING PORTS, COMPLIANT WITH EPA METHOD 1 WILL BE INSTALLED ON THE STACKS: <input checked="" type="checkbox"/> YES NO			
COMMENTS: These Boilers have NOx, SO₂ and CO₂ CEMS, Opacity COMs, O₂ trim and limestone feed rate monitoring systems in place.			

Attach Additional Sheets As Necessary

FORM C9

CONTROL DEVICE (OTHER)

REVISED 12/01/01

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

C9

CONTROL DEVICE ID NO: CD-004.1, 005.1		CONTROLS EMISSIONS FROM WHICH EMISSION SOURCE ID NO(S): ES-001, 002																																																	
EMISSION POINT (STACK) ID NO(S): EP 14-136		POSITION IN SERIES OF CONTROLS: NO. _____ OF _____ UNITS																																																	
MANUFACTURER: Integral to Boiler		MODEL NO: Integral to Boiler																																																	
DATE MANUFACTURED: Integral to Boiler		PROPOSED OPERATION DATE: Existing																																																	
OPERATING SCENARIO: 1-4 OF 1-4		PROPOSED START CONSTRUCTION DATE: Existing																																																	
		P.E. SEAL REQUIRED (PER 2Q .0112)? X YES NO																																																	
DESCRIBE CONTROL SYSTEM: Boiler Nos. 6 and 7 are circulating fluidized-bed units equipped with calcium carbonate (limestone) injection systems for the control of acid gases, including HCl. The limestone injection systems and associated baghouses also provide control of Hg emissions. The Title V air permit requires a limestone injection rate 112(j) operating limit set at the levels achieved during HCl and Hg compliance demonstration performance tests. Based on the July 9-10, 2013 HCl and Hg performance tests, the proposed limestone injection rate operating limit for both HCl-equivalent and Hg control is a maximum of 11.0 lbs of coal or wood per lb of limestone.																																																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;"></th> <th style="width: 10%; text-align: center;">Hg</th> <th style="width: 10%; text-align: center;">HCl-eq.</th> <th style="width: 10%;"></th> <th style="width: 10%;"></th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td>POLLUTANT(S) COLLECTED:</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">Variable</td> <td></td> <td></td> <td></td> </tr> <tr> <td>BEFORE CONTROL EMISSION RATE (LB/HR):</td> <td style="text-align: center;">100</td> <td style="text-align: center;">100</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> </tr> <tr> <td>CAPTURE EFFICIENCY:</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> </tr> <tr> <td>CONTROL DEVICE EFFICIENCY:</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> </tr> <tr> <td>CORRESPONDING OVERALL EFFICIENCY:</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">Variable</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> <td style="text-align: center;">%</td> </tr> <tr> <td>EFFICIENCY DETERMINATION CODE:</td> <td style="text-align: center;">NA</td> <td style="text-align: center;">NA</td> <td></td> <td></td> <td></td> </tr> <tr> <td>TOTAL EMISSION RATE (LB/HR):</td> <td style="text-align: center;">5.66E-05</td> <td style="text-align: center;">99.29</td> <td></td> <td colspan="2" style="text-align: right;"><i>Highest rate from 112(j) performance tests</i></td> </tr> </tbody> </table>					Hg	HCl-eq.				POLLUTANT(S) COLLECTED:	Variable	Variable				BEFORE CONTROL EMISSION RATE (LB/HR):	100	100	%	%	%	CAPTURE EFFICIENCY:	Variable	Variable	%	%	%	CONTROL DEVICE EFFICIENCY:	Variable	Variable	%	%	%	CORRESPONDING OVERALL EFFICIENCY:	Variable	Variable	%	%	%	EFFICIENCY DETERMINATION CODE:	NA	NA				TOTAL EMISSION RATE (LB/HR):	5.66E-05	99.29		<i>Highest rate from 112(j) performance tests</i>	
	Hg	HCl-eq.																																																	
POLLUTANT(S) COLLECTED:	Variable	Variable																																																	
BEFORE CONTROL EMISSION RATE (LB/HR):	100	100	%	%	%																																														
CAPTURE EFFICIENCY:	Variable	Variable	%	%	%																																														
CONTROL DEVICE EFFICIENCY:	Variable	Variable	%	%	%																																														
CORRESPONDING OVERALL EFFICIENCY:	Variable	Variable	%	%	%																																														
EFFICIENCY DETERMINATION CODE:	NA	NA																																																	
TOTAL EMISSION RATE (LB/HR):	5.66E-05	99.29		<i>Highest rate from 112(j) performance tests</i>																																															
PRESSURE DROP (IN. H ₂ O): MIN NA MAX NA		BULK PARTICLE DENSITY (LB/FT ³): NA																																																	
INLET TEMPERATURE (°F): MIN NA MAX NA		OUTLET TEMPERATURE (°F): MIN NA MAX NA																																																	
INLET AIR FLOW RATE (ACFM): NA		OUTLET AIR FLOW RATE (ACFM): NA																																																	
INLET AIR FLOW VELOCITY (FT/SEC): NA		OUTLET AIR FLOW VELOCITY (FT/SEC): NA																																																	
INLET MOISTURE CONTENT (%): NA		♪ FORCED AIR ♪ INDUCED AIR NA																																																	
COLLECTION SURFACE AREA (FT ²): NA		FUEL USED: NA FUEL USAGE RATE: NA																																																	
DESCRIBE STARTUP PROCEDURES: <p style="text-align: center;">NA</p>																																																			
DESCRIBE MAINTENANCE PROCEDURES: <p style="text-align: center;">NA</p>																																																			
DESCRIBE ANY AUXILIARY MATERIALS INTRODUCED INTO THE CONTROL SYSTEM: <p style="text-align: center;">NA</p>																																																			
DESCRIBE ANY MONITORING DEVICES, GAUGES, TEST PORTS, ETC: <p style="text-align: center;">NA</p>																																																			
ATTACH A DIAGRAM OF THE RELATIONSHIP OF THE CONTROL DEVICE TO ITS EMISSION SOURCE(S): <p style="text-align: center;">NA</p>																																																			
Attach manufacturer's specifications, schematics, and all other drawings necessary to describe this control.																																																			

Attach Additional Sheets As Necessary

FORM C1

CONTROL DEVICE (FABRIC FILTER)

REVISED 12/01/01

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

C1

CONTROL DEVICE ID NO: CD-004.2, 005.2		CONTROLS EMISSIONS FROM WHICH EMISSION SOURCE ID NO(S): ES-001, ES-002	
EMISSION POINT (STACK) ID NO(S): EP 14-136		POSITION IN SERIES OF CONTROLS NO. 1 OF 1 UNITS	
MANUFACTURER: United McGill		MODEL NO: Beta/Mark #2256-16	
DATE MANUFACTURED: Existing		PROPOSED OPERATION DATE: Existing	
OPERATING SCENARIO:		PROPOSED START CONSTRUCTION DATE: Existing	
1-4 OF 1-4		P.E. SEAL REQUIRED (PER 2Q .0112)? X YES <input type="checkbox"/> NO	

DESCRIBE CONTROL SYSTEM:

Boiler Nos. 6 and 7 are each equipped with a baghouse to control particulate, including metal HAPs, from fuel combustion and reacted and unreacted sorbent from limestone injection in the boilers. The baghouses provide additional acid gas (SO₂, HCl, and HF) control by unreacted sorbent in the filter cake. The baghouses in combination with the limestone injection also provide control of mercury. The Title V air permit limits visible emissions from the baghouses for 112(j) compliance with the PM and Hg limits to 20% opacity.

POLLUTANT(S) COLLECTED:	Filterable PM			
BEFORE CONTROL EMISSION RATE (LB/HR):	Variable			
CAPTURE EFFICIENCY:	100 %			
CONTROL DEVICE EFFICIENCY:	99.8 %			
CORRESPONDING OVERALL EFFICIENCY:	99.8 %			
EFFICIENCY DETERMINATION CODE:	Estimated			
TOTAL EMISSION RATE (LB/HR):	2.35	<i>Highest rate from 112(j) performance tests</i>		

PRESSURE DROP (IN. H ₂ O): 3.8 MIN: 6 MAX:	GAUGE? X YES NO	WARNING ALARM? X YES NO
BULK PARTICLE DENSITY (LB/FT ³): NA	INLET TEMPERATURE (°F): 300 MIN 350 MAX	
POLLUTANT LOADING RATE: Variable LB/HR GR/FT ³	OUTLET TEMPERATURE (°F): 300 MIN 350 MAX	
INLET AIR FLOW RATE (ACFM): 135,000	FILTER MAX OPERATING TEMP. (°F): 425	
NO. OF COMPARTMENTS:	NO. OF BAGS PER COMPARTMENT:	LENGTH OF BAG (IN.):
DIAMETER OF BAG (IN.):	DRAFT: X INDUCED/NEG. FORCED/POS.	FILTER SURFACE AREA (FT ²): 36,674
AIR TO CLOTH RATIO: 3.7	FILTER MATERIAL: Nomex	WOVEN FELTED

<p>DESCRIBE CLEANING PROCEDURES:</p> <p>X AIR PULSE SONIC</p> <p>REVERSE FLOW SIMPLE BAG COLLAPSE</p> <p>MECHANICAL/SHAKER RING BAG COLLAPSE</p> <p>OTHER</p> <p>DESCRIBE INCOMING AIR STREAM:</p> <p>Exhaust from 323.17 MMBtu/hr Boiler</p>	PARTICLE SIZE DISTRIBUTION		
	SIZE (MICRONS)	WEIGHT % OF TOTAL	CUMULATIVE %
	0-1		
	1-10		
	10-25		
	25-50		
	50-100		
	>100		
TOTAL = 100			

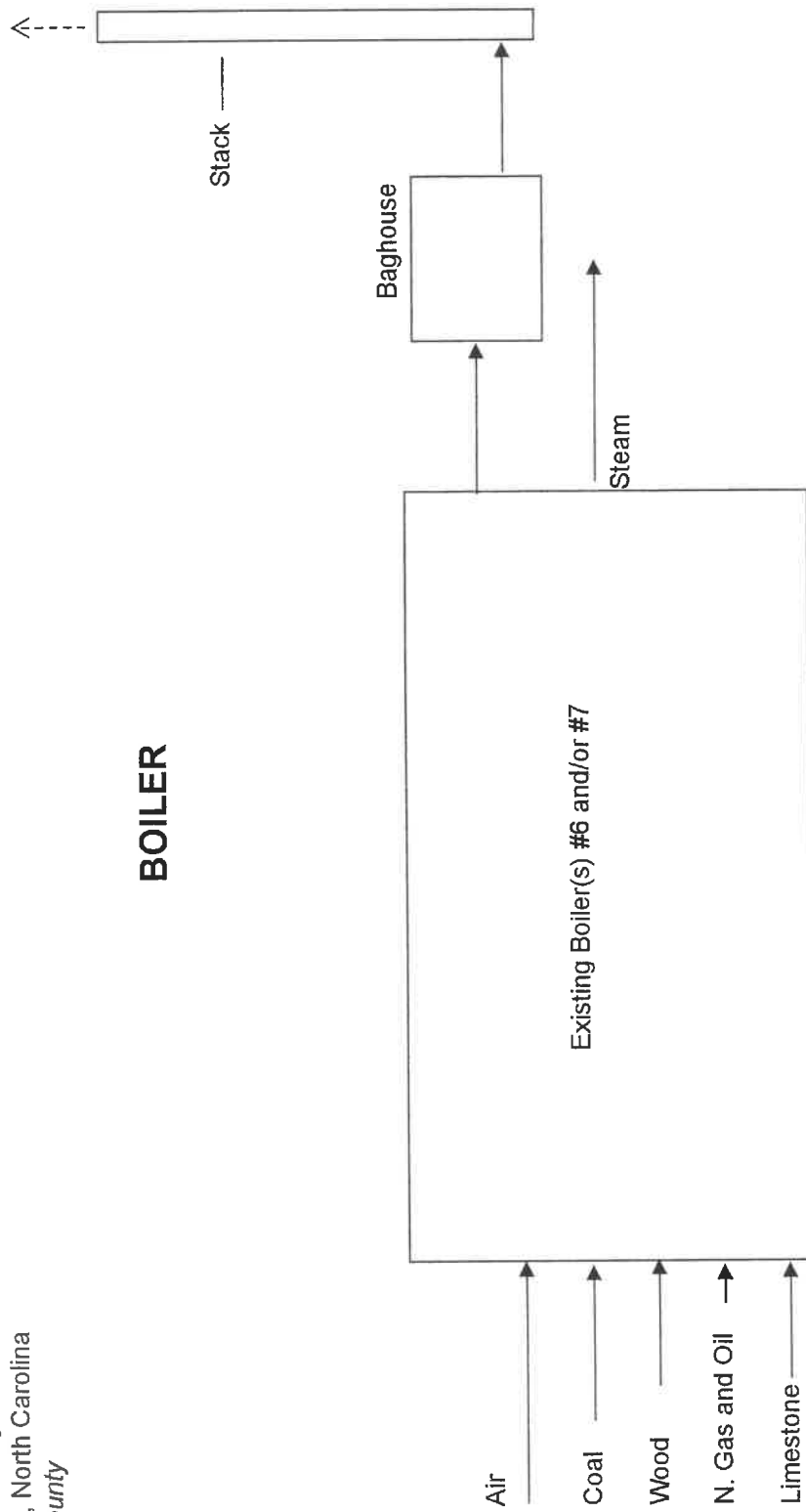
METHOD FOR DETERMINING WHEN TO CLEAN:		
AUTOMATIC	X TIMED	MANUAL
METHOD FOR DETERMINING WHEN TO REPLACE THE BAGS:		
ALARM	X INTERNAL INSPECTION	VISIBLE EMISSION OTHER
SPECIAL CONDITIONS:		
MOISTURE BLINDING	CHEMICAL RESISTIVITY	OTHER
EXPLAIN: None		

DESCRIBE MAINTENANCE PROCEDURES: **Follow manufacturer recommendations with a minimum annual internal inspection for necessary bag replacement and structural integrity.**

ON A SEPARATE PAGE, ATTACH A DIAGRAM SHOWING THE RELATIONSHIP OF THE CONTROL DEVICE TO ITS EMISSION SOURCE(S):

Attach Additional Sheets As Necessary

BOILER



Flow Diagram

FORM E3

EMISSION SOURCE COMPLIANCE METHOD

REVISED 12/01/01

NCDENR/Division Of Air Quality - Application for Air Permit to Construct/Operate

E3

Emission Source ID NO. ES-001, ES-002	Regulated Pollutant PM / TSM / Hg / Opacity
Alternative Operating Scenario (AOS) NO: 1 - 4	Applicable Regulation 15A NCAC 2D .1109, 112(j) Boiler MACT

ATTACH A SEPARATE PAGE TO EXPAND ON ANY OF THE BELOW COMMENTS

MONITORING REQUIREMENTS

Is Compliance Assurance Monitoring (CAM) 40 CFR Part 64 Applicable? Yes ☐ No ☒

If yes, is CAM Plan Attached (if applicable, CAM plan must be attached)? Yes ☐ No ☒

Describe Monitoring Device Type: Opacity COMs

Describe Monitoring Location: Exhaust Breeching Prior to Common Stack

Other Monitoring Methods (Describe In Detail):

NA

Describe the frequency and duration of monitoring and how the data will be recorded (i.e., every 15 minutes, 1 minute instantaneous readings taken to produce an hourly average):

Every 6-minutes

Operat. Limit - 20% Opacity - Six Minute Average - with One Six Minute Period per Hour of 27% Opacity

RECORDKEEPING REQUIREMENTS

Data (Parameter) being recording: 6 Minute Average Opacity

Frequency of recordkeeping (How often is data recorded?): Hourly

REPORTING REQUIREMENTS

Generally describe what is being reported:

Quarterly Emissions Monitoring Report including COMs data

COMs Downtime and Excess Emissions

Fuel records semiannually.

Frequency: MONTHLY ☐ X QUARTERLY ☒ EVERY 6 MONTHS ☐

X OTHER (DESCRIBE): Annual Emissions/Compliance Certification

TESTING

Specify proposed reference test method: Annual performance tests for PM

Specify reference test method rule and citation: Method 5

Specify testing frequency: Annually for 3-yrs, every 3rd year after 1st 3-years

NOTE - Proposed test method subject to approval and possible change during the test protocol process

Attach Additional Sheets As Necessary

FORM E3
EMISSION SOURCE COMPLIANCE METHOD

REVISED 12/01/01

NCDENR/Division Of Air Quality - Application for Air Permit to Construct/Operate

E3

Emission Source ID NO. **ES-001, ES-002**

Regulated Pollutant

HCl-eq. / Hg

Applicable Regulation

15A NCAC 2D .1109, 112(j) Boiler MACT

Alternative Operating Scenario (AOS) NO: **1- 4**

ATTACH A SEPARATE PAGE TO EXPAND ON ANY OF THE BELOW COMMENTS

MONITORING REQUIREMENTS

Is Compliance Assurance Monitoring (CAM) 40 CFR Part 64 Applicable? Yes

☒ No

If yes, is CAM Plan Attached (if applicable, CAM plan must be attached)? Yes

☒ No

Describe Monitoring Device Type:

Limestone feed rate & fuel feed rate CPMS

Describe Monitoring Location:

Fuel feed weigh belts/ calibrated limestone feed augers

Other Monitoring Methods (Describe In Detail):

The DAHS records the concurrent coal/wood feed rates and the limestone feed rate, and computes and records the fuel:limestone feed rate ratio in a lbs/lb format as specified in the Title V permit.

Describe the frequency and duration of monitoring and how the data will be recorded (i.e., every 15 minutes, 1 minute instantaneous readings taken to produce an hourly average):

Instantaneous fuel (coal/wood) to sorbent feed rate ratio recorded every 15-minutes

15-min. fuel:sorbent ratios converted to 3-hr block averages for comparison with operating limit

Proposed operating limit at 11.0 lbs/lb based on July 9-10, 2013 HCl-eq. and Hg performance tests

RECORDKEEPING REQUIREMENTS

Data (Parameter) being recording:

lbs of coal or wood per lb of limestone

Frequency of recordkeeping (How often is data recorded?):

Every 15-minutes

REPORTING REQUIREMENTS

Generally describe what is being reported:

**Semiannual Compliance Monitoring Report including Fuel:Sorbent Ratio CPMS data
CPMS Downtime and Excess Emissions semiannually.**

Fuel records semiannually.

Frequency:

☐ MONTHLY

☐ QUARTERLY

☒ EVERY 6 MONTHS

☒ OTHER (DESCRIBE):

Annual Emissions/Compliance Certification

TESTING

Specify proposed reference test method:

Annual performance tests for HCl-eq. and Hg

Specify reference test method rule and citation:

Methods 5, 26A, and 30B

Specify testing frequency:

Annually for 3-yrs, every 3rd year after 1st 3-years

NOTE - Proposed test method subject to approval and possible change during the test protocol process

Attach Additional Sheets As Necessary

FORM E3

EMISSION SOURCE COMPLIANCE METHOD

REVISED 12/01/01

NCDENR/Division Of Air Quality - Application for Air Permit to Construct/Operate

E3

Emission Source ID NO. ES-001, ES-002	Regulated Pollutant	CO
	Applicable Regulation	15A NCAC 2D .1109, 112(j) Boiler MACT
Alternative Operating Scenario (AOS) NO: 1-4		

ATTACH A SEPARATE PAGE TO EXPAND ON ANY OF THE BELOW COMMENTS

MONITORING REQUIREMENTS

Is Compliance Assurance Monitoring (CAM) 40 CFR Part 64 Applicable? Yes ☐ No ☒

If yes, is CAM Plan Attached (if applicable, CAM plan must be attached)? Yes ☐ No ☒

Describe Monitoring Device Type: Oxygen (O₂) Trim CPMS - Surrogate monitoring option for CO

Describe Monitoring Location: Boiler Furnace Outlet

Other Monitoring Methods (Describe In Detail): _____

Describe the frequency and duration of monitoring and how the data will be recorded (i.e., every 15 minutes, 1 minute instantaneous readings taken to produce an hourly average):

O₂ trim concentrations recorded every 15-minutes

15-min. O₂ concentrations converted to hourly and 30-day average concentrations by DAHS

30-day average operating limit at minimum 3.74% O₂ for CO compliance based
on December 17-18, 2014 CO 112(j) tests at >90% boiler load

RECORDKEEPING REQUIREMENTS

Data (Parameter) being recording: O₂ trim concentration

Frequency of recordkeeping (How often is data recorded?): Hourly

REPORTING REQUIREMENTS

Generally describe what is being reported: _____

Semiannual Compliance Monitoring Report including O₂ trim data

O₂ Trim CPMS Downtime and Excess Emissions

Fuel records semiannually.

Frequency: MONTHLY ☐ QUARTERLY ☐ ☒ EVERY 6 MONTHS

☒ OTHER (DESCRIBE): Annual Emissions/Compliance Certification

TESTING

Specify proposed reference test method: Annual performance tests for CO

Specify reference test method rule and citation: Methods 3A and 10

Specify testing frequency: Annually for 3-yrs, every 3rd year after 1st 3-years

NOTE - Proposed test method subject to approval and possible change during the test protocol process

Attach Additional Sheets As Necessary

The University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility-wide Forms

FORM E1

TITLE V GENERAL INFORMATION

REVISED: 12/01/01

Division of Air Quality - Application for Air Permit to Construct/Operate

E1

IF YOUR FACILITY IS CLASSIFIED AS "MAJOR" FOR TITLE V YOU MUST COMPLETE THIS FORM AND ALL OTHER REQUIRED "E" FORMS (E2 THROUGH E5 AS APPLICABLE)

Indicate here if your facility is subject to Title V by: ☒ Emissions ☒ Other

If subject to Title V by other, check or specify: ☒ NSPS ☒ NESHAPS (MACT) NA TITLE IV

Other, specify:

If you are or will be subject to any maximum achievable control technology standards (MACT) issued pursuant to section 112(d) of the Clean Air Act, specify below:

EMISSION SOURCE ID	EMISSION SOURCE DESCRIPTION	MACT
ES-001	323.17 MMBtu/hr boiler	40 CFR 63 - Subpart DDDDD - Boiler MACT
ES-002	323.17 MMBtu/hr boiler	40 CFR 63 - Subpart DDDDD - Boiler MACT
ES-003	338.0 MMBtu/hr boiler	40 CFR 63 - Subpart DDDDD - Boiler MACT
ES-004	249.0 MMBtu/hr boiler	40 CFR 63 - Subpart DDDDD - Boiler MACT
ES-005	249.0 MMBtu/hr boiler	40 CFR 63 - Subpart DDDDD - Boiler MACT
ES-SB-6	2.52 MMBtu/hr Boiler	40 CFR 63 - Subpart DDDDD - Boiler MACT
ES-006	2,000 kW generator	40 CFR 63 - Subpart ZZZZ - RICE MACT
ES-007	2,000 kW generator	40 CFR 63 - Subpart ZZZZ - RICE MACT
85 Em. Generators	All Emergency Generators	40 CFR 63 - Subpart ZZZZ - RICE MACT
3 Diesel fire pumps	All Diesel fire pumps	40 CFR 63 - Subpart ZZZZ - RICE MACT

List any additional regulation which are requested to be included in the shield and provide a detailed explanation as to why the shield should be granted:

REGULATION	EMISSION SOURCE (Include ID)	EXPLANATION
All	All	See Permit No. 03069T32 for existing sources and applicable regulations

Comments: All air pollution sources at the University and applicable regulations are identified in Permit No. 03069T32. All applicable regulations should be included in the permit shield.

Attach Additional Sheets As Necessary

FORM E2

Division of Air Quality - Application for Air Permit to Construct/Operate

E2

[illegible]

Attach Additional Sheets As Necessary

FORM E4
EMISSION SOURCE COMPLIANCE SCHEDULE

Revised 12/01/01

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

E4

COMPLIANCE STATUS WITH RESPECT TO ALL APPLICABLE REQUIREMENTS

Will each emission source at your facility be in compliance with all applicable requirements at the time of permit issuance and continue to comply with these requirements?

☒ Yes ☐ No

If NO, complete A through F below for each requirement for which compliance is not achieved.

Will your facility be in compliance with all applicable requirements taking effect during the term of the permit and meet such requirements on a timely basis?

☒ Yes ☐ No

If NO, complete A through F below for each requirement for which compliance is not achieved.

If this application is for a modification of existing emissions source(s), is each emission source currently in compliance with all applicable requirements?

☒ Yes ☐ No

If NO, complete A through F below for each requirement for which compliance is not achieved

A. Emission Source Description (Include ID NO.) _____

B. Identify applicable requirement for which compliance is not achieved:

C. Narrative description of how compliance will be achieved with this applicable requirements:

D. Detailed Schedule of Compliance:

Step(s)

Date Expected

<hr/>	<hr/>
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E. Frequency for submittal of progress reports (6 month minimum):

F. Starting date of submittal of progress reports:

Attach Additional Sheets As Necessary

Received

FORM E5

TITLE V COMPLIANCE CERTIFICATION (Required)

MAY 08 2015

Revised 12/01/01

NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

Air Permits Section E5

In accordance with the provisions of Title 15A NCAC 2Q .0520 the responsible company official of:

SITE NAME: The University of North Carolina at Chapel Hill

SITE ADDRESS: 1120 Estes Drive Extension

CITY, NC : Chapel Hill, North Carolina

COUNTY: Orange

PERMIT NUMBER : 03069T32

CERTIFIES THAT(Check the appropriate box):

☒ **The facility is in compliance with all applicable requirements**

☐ **The facility is not currently in compliance with all applicable requirements**

If this box is checked, you must also complete form E4 "Emission Source Compliance Schedule"

The undersigned certifies under the penalty of law, that all information and statements provided in the application, based on information and belief formed after reasonable inquiry, are true, accurate, and complete.


Signature of responsible company official (REQUIRED, USE BLUE INK)

Date:

5/5/15

Matthew M. Fajack, Vice Chancellor for Finance and Administration

Name, Title of responsible company official (Type or print)

Attach Additional Sheets As Necessary

FORM D

Received

TECHNICAL ANALYSIS TO SUPPORT PERMIT APPLICATION

MAY 06 2015

REVISED: 12/01/01

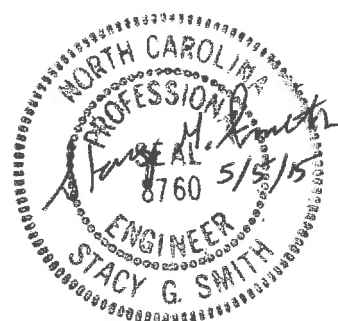
NCDENR/Division of Air Quality - Application for Air Permit to Construct/Operate

D5

PROVIDE DETAILED TECHNICAL CALCULATIONS TO SUPPORT ALL EMISSION, CONTROL, AND REGULATORY DEMONSTRATIONS MADE IN THIS APPLICATION. INCLUDE A COMPREHENSIVE PROCESS FLOW DIAGRAM AS NECESSARY TO SUPPORT AND CLARIFY CALCULATIONS AND ASSUMPTIONS. ADDRESS THE FOLLOWING SPECIFIC ISSUES ON SEPARATE PAGES:

A	SPECIFIC EMISSIONS SOURCE (EMISSION INFORMATION) (FORM B) - SHOW CALCULATIONS USED, INCLUDING EMISSION FACTORS, MATERIAL BALANCES, AND/OR OTHER METHODS FROM WHICH THE POLLUTANT EMISSION RATES IN THIS APPLICATION WERE DERIVED. INCLUDE CALCULATION OF POTENTIAL BEFORE AND, WHERE APPLICABLE, AFTER CONTROLS. CLEARLY STATE ANY ASSUMPTIONS MADE AND PROVIDE ANY REFERENCES AS NEEDED TO SUPPORT MATERIAL BALANCE CALCULATIONS.
B	SPECIFIC EMISSION SOURCE (REGULATORY INFORMATION)(FORM E2 - TITLE V ONLY) - PROVIDE AN ANALYSIS OF ANY REGULATIONS APPLICABLE TO INDIVIDUAL SOURCES AND THE FACILITY AS A WHOLE. INCLUDE A DISCUSSION OUTING METHODS (e.g. FOR TESTING AND/OR MONITORING REQUIREMENTS) FOR COMPLYING WITH APPLICABLE REGULATIONS, PARTICULARLY THOSE REGULATIONS LIMITING EMISSIONS BASED ON PROCESS RATES OR OTHER OPERATIONAL PARAMETERS. PROVIDE JUSTIFICATION FOR AVOIDANCE OF ANY FEDERAL REGULATIONS (PREVENTION OF SIGNIFICANT DETERIORATION (PSD), NEW SOURCE PERFORMANCE STANDARDS (NSPS), NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPS), TITLE V), INCLUDING EXEMPTIONS FROM THE FEDERAL REGULATIONS WHICH WOULD OTHERWISE BE APPLICABLE TO THIS FACILITY. SUBMIT ANY REQUIRED TO DOCUMENT COMPLIANCE WITH ANY REGULATIONS. INCLUDE EMISSION RATES CALCULATED IN ITEM "A" ABOVE, DATES OF MANUFACTURE, CONTROL EQUIPMENT, ETC. TO SUPPORT THESE CALCULATIONS.
C	CONTROL DEVICE ANALYSIS (FORM C) - PROVIDE A TECHNICAL EVALUATION WITH SUPPORTING REFERENCES FOR ANY CONTROL EFFICIENCIES LISTED ON SECTION C FORMS, OR USED TO REDUCE EMISSION RATES IN CALCULATIONS UNDER ITEM "A" ABOVE. INCLUDE PERTINENT OPERATING PARAMETERS (e.g. OPERATING CONDITIONS, MANUFACTURING RECOMMENDATIONS, AND PARAMETERS AS APPLIED FOR IN THIS APPLICATION) CRITICAL TO ENSURING PROPER PERFORMANCE OF THE CONTROL DEVICES). INCLUDE AND LIMITATIONS OR MALFUNCTION POTENTIAL FOR THE PARTICULAR CONTROL DEVICES AS EMPLOYED AT THIS FACILITY. DETAIL PROCEDURES FOR ASSURING PROPER OPERATION OF THE CONTROL DEVICE INCLUDING MONITORING SYSTEMS AND MAINTENANCE TO BE PERFORMED.
D	PROCESS AND OPERATIONAL COMPLIANCE ANALYSIS - (FORM E3 - TITLE V ONLY) - SHOWING HOW COMPLIANCE WILL BE ACHIEVED WHEN USING PROCESS, OPERATIONAL, OR OTHER DATA TO DEMONSTRATE COMPLIANCE. REFER TO COMPLIANCE REQUIREMENTS IN THE REGULATORY ANALYSIS IN ITEM "B" WHERE APPROPRIATE. LIST ANY CONDITIONS OR PARAMETERS THAT CAN BE MONITORED AND REPORTED TO DEMONSTRATE COMPLIANCE WITH THE APPLICABLE REGULATIONS.
E	<p>PROFESSIONAL ENGINEERING SEAL - PURSUANT TO 15A NCAC 2Q.0112 "APPLICATION REQUIRING A PROFESSIONAL ENGINEERING SEAL," A PROFESSIONAL ENGINEER REGISTERED IN NORTH CAROLINA SHALL BE REQUIRED TO SEAL TECHNICAL PORTIONS OF THIS APPLICATION FOR NEW SOURCES AND MODIFICATIONS OF EXISTING SOURCES. (SEE INSTRUCTIONS FOR FURTHER APPLICABILITY).</p> <p>I, <u>Stacy Smith, P.E.</u>, attest that this application for <u>The University of North Carolina at Chapel Hill</u> has been reviewed by me and is accurate, complete and consistent with the information supplied in the engineering plans, calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package may have been developed by other professionals, inclusion of these materials under my seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design. Note: In accordance with NC General Statutes 143-215.6A and 143-215.6B, any person who knowingly makes any false statement, representation, or certification in any application shall be guilty of a Class 2 misdemeanor which may include a fine not to exceed \$10,000 as well as civil penalties up to \$25,000 per violation.</p> <p>(PLEASE USE BLUE INK TO COMPLETE THE FOLLOWING)</p> <p>NAME: <u>Stacy G. Smith</u></p> <p>DATE: <u>5/5/15</u></p> <p>COMPANY: <u>RST Engineering, PLLC</u></p> <p>ADDRESS: <u>5416 Orchard Oriole Trail, Wake Forest, N.C.</u></p> <p>TELEPHONE: <u>(919) 810 -9875</u></p> <p>SIGNATURE: <u>Stacy G. Smith</u></p> <p>PAGES CERTIFIED: <u>Entire Application</u></p> <p>(IDENTIFY ABOVE EACH PERMIT FORM AND ATTACHMENT THAT IS BEING CERTIFIED BY THIS SEAL)</p>

PLACE NORTH CAROLINA SEAL HERE



RST Engineering, PLLC

Attach Additional Sheets As Necessary

**112 (j) POTENTIAL EMISSIONS EVALUATION
AND ASSOCIATED OPERATIONAL PARAMETERS**

BASED ON THREE(3) SEPARATE PERFORMANCE TESTS

TEST DATES

July 9-10, 2013

March 4-5, 2014

December 17-18, 2014

The University of North Carolina at Chapel Hill

Chapel Hill, North Carolina
Orange County

Boiler Nos. 6 and 7 112(j) Regulated Pollutants

Operational Parameters

323.17 MMBtu/hr, Maximum Heat Input
8760 hr/yr, Maximum Operating Hours per Year

Potential Emissions Based on July 9-10, 2013 Performance Tests

Potential Emissions - Each Boiler

Pollutant	Boiler 6 Measured Emissions (lb/MMBtu)	Boiler 7 Measured Emissions (lb/MMBtu)	Emission Factor (lb/MMBtu) ¹	Emissions (lb/hr)	Emissions (lb/yr)	Emissions (ton/yr)
Filterable PM	0.00253	0.00253	0.00253	0.82	7,162.4	3.58
Hg	4.90E-08	5.52E-08	5.52E-08	1.78E-05	0.16	7.81E-05
HCl	0.122	0.107	0.122	39.43	345,378	172.7
Cl ₂	1.68E-04	2.09E-04	2.09E-04	0.068	591.7	0.30
CO	0.0619	0.0616	0.0619	20.00	175,237.0	87.6

1 - Highest unit emission rate during July 9-10, 2013 performance tests

	Boiler 6	Boiler 7		112(j) Limits
Operating Load	144,101	138,097	lb/hr steam	0.08 lb/MMBtu, filterable PM
	57.6%	55.2%	% of load	3.00E-06 lb/MMBtu,mercury (Hg)
Coal, Hv	12,593	12,900	Btu/lb	435.5 lb/hr, total HCl-equivalents from both B6 & B7
Coal chlorine	1,900	1,900	ppm	133 ppmvd @ 7% O ₂ , CO
Coal mercury	0.080	0.077	mg/kg	
Hg, % of limit	1.63%	1.84%		
coal/limestone	11.08	10.79	lb/lb during HCl and Cl ₂ tests	
	11.14	10.79	lb/lb during Hg tests	
CO, ppm @7%O ₂	57.86	57.63		
CO, % of limit	43.50%	43.33%		
O ₂ trim	6.76	9.02	%, O ₂	

Potential Emissions Based on March 4-5, 2014 Performance Tests

Potential Emissions - Each Boiler

Pollutant	Boiler 6 Measured Emissions (lb/MMBtu)	Boiler 7 Measured Emissions (lb/MMBtu)	Emission Factor (lb/MMBtu) ¹	Emissions (lb/hr)	Emissions (lb/yr)	Emissions (ton/yr)
Filterable PM	0.00495	0.00125	0.00495	1.60	14,013.3	7.01
Hg	1.72E-07	1.61E-07	1.72E-07	5.56E-05	0.49	2.43E-04
HCl	0.0454	0.0402	0.0454	14.67	128,526	64.3
Cl ₂	8.45E-05	5.41E-05	8.45E-05	0.029	254.0	0.13
CO	NA	NA	NA	NA	NA	NA

1 - Highest unit emission rate during March 4-5, 2014 performance tests

	Boiler 6	Boiler 7		112(j) Limits
Operating Load	232,152	233,134	lb/hr steam	0.08 lb/MMBtu, filterable PM
	92.9%	93.3%	% of load	3.00E-06 lb/MMBtu,mercury (Hg)
Coal, Hv	13,153	13,153	Btu/lb	435.5 lb/hr, total HCl-equivalents from both B6 & B7
Coal chlorine	867	600	ppm	133 ppmvd @ 7% O ₂ , CO
Coal mercury	0.137	0.133	mg/kg	
Hg, % of limit	5.73%	5.37%		
coal/limestone	9.00	9.53	lb/lb during HCl and Cl ₂ tests	
	8.95	9.53	lb/lb during Hg tests	
CO, ppm @7%O ₂	NA	NA		
CO, % of limit	NA	NA		
O ₂ trim	4.02	4.61	%, O ₂	

The University of North Carolina at Chapel HillChapel Hill, North Carolina
Orange County**Boiler Nos. 6 and 7
112(j) Regulated Pollutants****Operational Parameters**323.17 MMBtu/hr, Maximum Heat Input
8760 hr/yr, Maximum Operating Hours per Year**Potential Emissions Based on December 17-18, 2014 Performance Tests****Potential Emissions - Each Boiler**

Pollutant	Boiler 6 Measured Emissions (lb/MMBtu)	Boiler 7 Measured Emissions (lb/MMBtu)	Emission Factor (lb/MMBtu) ¹	Emissions (lb/hr)	Emissions (lb/yr)	Emissions (ton/yr)
Filterable PM	0.00215	0.00727	0.00727	2.35	20,581.1	10.29
Hg	1.73E-07	1.75E-07	1.75E-07	5.66E-05	0.50	2.48E-04
HCl	0.069	0.0582	0.069	22.30	195,337	97.7
Cl ₂	2.20E-08	1.67E-08	2.20E-08	0.000	0.062	3.11E-05
CO	0.0264	0.0222	0.0264	8.53	74,737.6	37.4

¹ - Highest unit emission rate during December 17-18, 2014 performance tests

	<u>Boiler 6</u>	<u>Boiler 7</u>		<u>112(j) Limits</u>
Operating Load	231,696	231,731	lb/hr steam	0.08 lb/MMBtu, filterable PM
	92.7%	92.7%	% of load	3.00E-06 lb/MMBtu, mercury (Hg)
Coal, Hv	12,148	11,476	Btu/lb	435.5 lb/hr, total HCl-equivalents from both B6 & B7
Coal chlorine	1,077	730	ppm	133 ppmvd @ 7% O ₂ , CO
Coal mercury	0.19	0.18	mg/kg	
Hg, % of limit	5.77%	5.83%		
coal/limestone	8.57	8.54	lb/lb during HCl and Cl ₂ tests	
	8.57	8.54	lb/lb during Hg tests	
CO, ppm @7%O ₂	24.66	20.72		
CO, % of limit	18.54%	15.58%		
O ₂ trim	4.32	4.02	%, O ₂	

Potential Controlled HCl Equivalent Emissions
Maximum Toxicity-Weighted Hourly Emission Rates

A. July 9-10, 2013 Performance Tests

Boiler No.	Maximum Emission Rate		Reference Values		HCl-Equivalent ¹ Emission Rate
	HCl	Cl ₂	HCl	Cl ₂	
	(lb/hr)	(lb/hr)	(ug/m3)	(ug/m3)	(lb/hr)
No.6	26.50	3.64E-02	20	0.2	30.14
No.7	21.70	4.26E-02	20	0.2	25.96
No.8	NA	NA	NA	NA	NA
No.9	NA	NA	NA	NA	NA
No.10	NA	NA	NA	NA	NA
SB-6	NA	NA	NA	NA	NA
SB-15	NA	NA	NA	NA	NA
Total	48.20	0.079			56.10

1 - From Equation 2 in Appendix A of Subpart DDDDD.

B. Equivalent Emission Rate at 100% Boiler Rated Capacity

Boiler No.	Steam Capacity		Percentage of Max, During Test	HCl-Equivalent Max. Emiss. Rate
	Maximum	During Test		
	(lb/hr)	(lb/hr)	%	(lb/hr)
No.6	250,000	144,101	57.6	52.29
No.7	250,000	138,097	55.2	47.00
Total	-	-	-	99.29

C. Allowed HCl-Equivalent Emission Rate

Total **435.5** lb/hr

D. Percent of limit
22.80%

Potential Controlled HCl Equivalent Emissions
Maximum Toxicity-Weighted Hourly Emission Rates

A. March 4-5, 2014 Performance Tests

	Maximum Emission Rate		Reference Values		HCl-Equivalent ¹ Emission Rate
	HCl	Cl ₂	HCl	Cl ₂	
Boiler No.	(lb/hr)	(lb/hr)	(ug/m3)	(ug/m3)	(lb/hr)
No.6	15.50	2.90E-02	20	0.2	18.40
No.7	13.70	1.85E-02	20	0.2	15.55
No.8	NA	NA	NA	NA	NA
No.9	NA	NA	NA	NA	NA
No.10	NA	NA	NA	NA	NA
SB-6	NA	NA	NA	NA	NA
SB-15	NA	NA	NA	NA	NA
Total	29.20	0.048			33.95

1 - From Equation 2 in Appendix A of Subpart DDDDD.

B. Equivalent Emission Rate at 100% Boiler Rated Capacity

	Steam Capacity		Percentage of Max, During Test	HCl-Equivalent Max. Emiss. Rate
	Maximum	During Test		
Boiler No.	(lb/hr)	(lb/hr)	%	(lb/hr)
No.6	250,000	232,152	92.9	19.81
No.7	250,000	233,134	93.3	16.67
Total	-	-	-	36.49

C. Allowed HCl-Equivalent Emission Rate

Total **435.5** lb/hr

D. Percent of limit

8.38%

Potential Controlled HCl Equivalent Emissions
Maximum Toxicity-Weighted Hourly Emission Rates

A. December 16-17, 2014 Performance Tests

	Maximum Emission Rate		Reference Values		HCl-Equivalent ¹ Emission Rate
	HCl	Cl ₂	HCl	Cl ₂	
Boiler No.	(lb/hr)	(lb/hr)	(ug/m3)	(ug/m3)	(lb/hr)
No.6	22.90	7.29E-06	20	0.2	22.90
No.7	19.90	5.70E-06	20	0.2	19.90
No.8	NA	NA	NA	NA	NA
No.9	NA	NA	NA	NA	NA
No.10	NA	NA	NA	NA	NA
SB-6	NA	NA	NA	NA	NA
SB-15	NA	NA	NA	NA	NA
Total	42.80	0.000			42.80

1 - From Equation 2 in Appendix A of Subpart DDDDD.

B. Equivalent Emission Rate at 100% Boiler Rated Capacity

	Steam Capacity		Percentage of Max, During Test	HCl-Equivalent Max. Emiss. Rate
	Maximum	During Test		
Boiler No.	(lb/hr)	(lb/hr)	%	(lb/hr)
No.6	250,000	231,696	92.68	24.71
No.7	250,000	231,731	92.69	21.47
Total	-	-	-	46.18

C. Allowed HCl-Equivalent Emission Rate

Total **435.5** lb/hr

D. Percent of limit

10.60%

Attachment A

The University of North Carolina at Chapel Hill

Boiler Nos. 6 and 7

July 9-10, 2013 Tests

112(j) Performance Test Results

TABLE 2-1
UNIT 6 FILTERABLE PARTICULATE, HYDROGEN CHLORIDE, HYDROGEN
FLUORIDE, AND CHLORINE RESULTS
JULY 2013

	U6-M5/26A-1	U6-M5/26A-2	U6-M5/26A-3	Average
Test Date	07/09/2013	07/09/2013	07/09/2013	
Start Time	1221	1405	1545	
Finish Time	1340	1516	1654	
Net Run Time, minutes	62.5	62.5	62.5	
Barometric Pressure, in Hg	29.60	29.60	29.60	29.60
Moisture Content, % by volume	9.08	8.91	8.99	9.00
Dry Mole Fraction	0.909	0.911	0.910	0.910
Carbon Dioxide, % by volume, dry	11.7	11.5	11.4	11.5
Oxygen, % by volume dry	7.7	7.9	8.0	7.9
Flue Gas Static Pressure, in H ₂ O	-9.7	-10.2	-9.9	-9.9
Flue Gas Temperature, °F	351	355	359	355
Volumetric Flow Rate, dry SCFM*	57,776	55,713	56,044	56,511
F-Factor, DSCF/million Btu @ 68°F	9,780	9,780	9,780	--
Filterable Particulate				
Concentration, gr/dscf	0.00124	0.000670	0.00148	0.00113
Concentration, gr/dscf @7%	0.00131	0.000717	0.00159	0.00121
Emission Rate, lb/hr	0.614	0.320	0.711	0.548
Emission Rate, lb/mmBtu	0.00274	0.00151	0.00335	0.00253
Hydrogen Chloride				
Concentration, ppmvd	84.5	81.5	81.4	82.4
Concentration, ppmvd @7%	88.9	87.1	87.7	87.9
Emission Rate, lb/hr	27.7	25.8	25.9	26.5
Emission Rate, lb/mmBtu	0.124	0.121	0.122	0.122
Hydrogen Fluoride				
Concentration, ppmvd	3.26E-01	4.08E-01	3.81E-01	3.72E-01
Concentration, ppmvd @7%	3.44E-01	4.36E-01	4.10E-01	3.97E-01
Emission Rate, lb/hr	5.87E-02	7.08E-02	6.65E-02	6.53E-02
Emission Rate, lb/mmBtu	2.62E-04	3.33E-04	3.13E-04	3.03E-04
Chlorine as Cl₂				
Concentration, ppmvd	6.76E-02	4.98E-02	5.72E-02	5.82E-02
Concentration, ppmvd @7%	7.12E-02	5.33E-02	6.16E-02	6.20E-02
Emission Rate, lb/hr	4.31E-02	3.07E-02	3.54E-02	3.64E-02
Emission Rate, lb/mmBtu	1.93E-04	1.44E-04	1.67E-04	1.68E-04

TABLE 2-2
UNIT 6 CARBON MONOXIDE TEST RESULTS
JULY 2013

	U6-CEM-1	U6-CEM-2	U6-CEM-3	Average
Test Date	07/09/2013	07/09/2013	07/09/2013	
Start Time	1210	1412	1545	
Finish Time	1310	1512	1645	
Net Run Time, minutes	60	60	60	
Barometric Pressure, in Hg	29.60	29.60	29.60	29.60
Moisture Content, % by volume	9.08	8.91	8.99	9.00
Dry Mole Fraction	0.909	0.911	0.910	0.910
Carbon Dioxide, % by volume, dry	11.7	11.5	11.4	11.5
Oxygen, % by volume dry	7.7	7.9	8.0	7.9
Flue Gas Static Pressure, in H ₂ O	-9.7	-10.2	-9.9	-9.9
Flue Gas Temperature, °F	351	355	359	355
Volumetric Flow Rate, dry SCFM*	57,776	55,713	56,044	56,511
F-Factor, DSCF/million Btu @ 68°F	9,780	9,780	9,780	--
Carbon Monoxide				
Concentration, ppmvd	54.85	53.59	54.32	54.25
Concentration, ppmvd @7%	57.76	57.30	58.53	57.86
Concentration, ppmw	49.87	48.81	49.43	49.37
Emission Rate, lb/hr	13.8	13.0	13.3	13.4
Emission Rate, lb/mmBtu	0.0617	0.0613	0.0626	0.0619

TABLE 2-3
UNIT 6 MERCURY TEST RESULTS
JULY 2013

	U6-M30B-1	U6-M30B-2	U6-M30B-3	Average
Test Date	07/09/2013	07/09/2013	07/09/2013	
Start Time	1210	1420	1600	
Finish Time	1310	1520	1700	
Net Run Time, minutes	60	60	60	
Barometric Pressure, in Hg	29.60	29.60	29.60	29.60
Moisture Content, % by volume	9.08	8.91	8.99	9.00
Dry Mole Fraction	0.909	0.911	0.910	0.910
Carbon Dioxide, % by volume, dry	11.7	11.5	11.4	11.5
Oxygen, % by volume dry	7.7	7.9	8.0	7.9
Flue Gas Static Pressure, in H ₂ O	-9.7	-10.2	-9.9	-9.9
Flue Gas Temperature, °F	351	355	359	355
Volumetric Flow Rate, dry SCFM*	57,776	55,713	56,044	56,511
F-Factor, DSCF/million Btu @ 68°F	9,780	9,780	9,780	--
Mercury				
Concentration, ug/dscm	0.053	0.035	0.062	0.050
Emission Rate, lb/hr	1.15E-05	7.30E-06	1.30E-05	1.06E-05
Emission Rate, lb/mmBtu	5.12E-08	3.44E-08	6.13E-08	4.90E-08

TABLE 2-4
UNIT 7 FILTERABLE PARTICULATE, HYDROGEN CHLORIDE, HYDROGEN
FLUORIDE, AND CHLORINE RESULTS
JULY 2013

	U7-M5/26A-1	U7-M5/26A-2	U7-M5/26A-3	Average
Test Date	07/10/2013	07/10/2013	07/10/2013	
Start Time	1020	1215	1355	
Finish Time	1129	1323	1508	
Net Run Time, minutes	62.5	62.5	62.5	
Barometric Pressure, in Hg	29.50	29.50	29.50	29.50
Moisture Content, % by volume	8.38	8.46	8.45	8.43
Dry Mole Fraction	0.916	0.915	0.915	0.916
Carbon Dioxide, % by volume, dry	11.3	11.0	11.0	11.1
Oxygen, % by volume dry	8.4	8.6	8.5	8.5
Flue Gas Static Pressure, in H ₂ O	-10.5	-8.6	-10.5	-9.9
Flue Gas Temperature, °F	374	365	369	369
Volumetric Flow Rate, dry SCFM*	56,098	55,663	55,425	55,729
F-Factor, DSCF/million Btu @ 68°F	9,780	9,780	9,780	--
Filterable Particulate				
Concentration, gr/dscf	0.00106	0.000597	0.00157	0.00108
Concentration, gr/dscf @7%	0.00118	0.000674	0.00176	0.00121
Emission Rate, lb/hr	0.515	0.285	0.745	0.515
Emission Rate, lb/mmBtu	0.00249	0.00142	0.00370	0.00253
Hydrogen Chloride				
Concentration, ppmvd	54.6	70.4	80.1	68.4
Concentration, ppmvd @7%	60.7	79.5	89.8	76.7
Emission Rate, lb/hr	17.4	22.2	25.2	21.6
Emission Rate, lb/mmBtu	0.0845	0.111	0.125	0.107
Hydrogen Fluoride				
Concentration, ppmvd	6.86E-02	8.10E-02	8.94E-02	7.97E-02
Concentration, ppmvd @7%	7.63E-02	9.16E-02	1.00E-01	8.94E-02
Emission Rate, lb/hr	1.21E-02	1.41E-02	1.54E-02	1.39E-02
Emission Rate, lb/mmBtu	5.83E-05	6.99E-05	7.65E-05	6.83E-05
Chlorine as Cl₂				
Concentration, ppmvd	8.43E-02	5.88E-02	6.38E-02	6.90E-02
Concentration, ppmvd @7%	9.38E-02	6.64E-02	7.15E-02	7.72E-02
Emission Rate, lb/hr	5.26E-02	3.61E-02	3.90E-02	4.26E-02
Emission Rate, lb/mmBtu	2.54E-04	1.80E-04	1.94E-04	2.09E-04

TABLE 2-5
UNIT 7 CARBON MONOXIDE TEST RESULTS
JULY 2013

	U7-CEM-1	U7-CEM-2	U7-CEM-3	Average
Test Date	07/10/2013	07/10/2013	07/10/2013	
Start Time	1020	1215	1355	
Finish Time	1120	1315	1555	
Net Run Time, minutes	60	60	60	
Barometric Pressure, in Hg	29.50	29.50	29.50	29.50
Moisture Content, % by volume	8.38	8.46	8.45	8.43
Dry Mole Fraction	0.916	0.915	0.915	0.916
Carbon Dioxide, % by volume, dry	11.3	11.0	11.0	11.1
Oxygen, % by volume dry	8.4	8.6	8.5	8.5
Flue Gas Static Pressure, in H ₂ O	-10.5	-8.6	-10.5	-9.9
Flue Gas Temperature, °F	374	365	369	369
Volumetric Flow Rate, dry SCFM*	56,098	55,663	55,425	55,729
F-Factor, DSCF/million Btu @ 68°F	9,780	9,780	9,780	--
Carbon Monoxide				
Concentration, ppmvd	44.25	53.87	56.03	51.38
Concentration, ppmvd @7%	49.21	60.88	62.81	57.63
Concentration, ppmw	40.54	49.31	51.29	47.05
Emission Rate, lb/hr	10.8	13.1	13.5	12.5
Emission Rate, lb/mmBtu	0.0526	0.0651	0.0671	0.0616

TABLE 2-6
UNIT 7 MERCURY TEST RESULTS
JULY 2013

	U7-M30B-1	U7-M30B-2	U7-M30B-3	Average
Test Date	07/10/2013	07/10/2013	07/10/2013	
Start Time	1035	1230	1414	
Finish Time	1135	1330	1514	
Net Run Time, minutes	60	60	60	
Barometric Pressure, in Hg	29.50	29.50	29.50	29.50
Moisture Content, % by volume	8.38	8.46	8.45	8.43
Dry Mole Fraction	0.916	0.915	0.915	0.916
Carbon Dioxide, % by volume, dry	11.3	11.0	11.0	11.1
Oxygen, % by volume dry	8.4	8.6	8.5	8.5
Flue Gas Static Pressure, in H ₂ O	-10.5	-8.6	-10.5	-9.9
Flue Gas Temperature, °F	374	365	369	369
Volumetric Flow Rate, dry SCFM*	56,098	55,663	55,425	55,729
F-Factor, DSCF/million Btu @ 68°F	9,780	9,780	9,780	--
Mercury				
Concentration, ug/dscm	0.056	0.052	0.053	0.054
Emission Rate, lb/hr	1.19E-05	1.08E-08	1.10E-05	1.12E-05
Emission Rate, lb/mmBtu	5.72E-08	5.40E-08	5.45E-08	5.52E-08

Attachment B

The University of North Carolina at Chapel Hill

**Boiler Operating Load Analyses
2013 - 2014**

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Load Range Analysis Report

Boiler #6 UNC Cogen

Date of Report: 04/07/2015 Report Period: 01/01/2013 - 12/31/2013

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Number of on Line Hours :7419

Low Range Hours	:	3576.0	Percent :	58.6	Bounds	70.0 to	124.0
Mid Range Hours	:	1972.0	Percent :	32.3	Bounds	124.0 to	178.0
High Range Hours	:	554.0	Percent :	9.1	Bounds	178.0 to	250.0
Hours In Range	:	6102					
Hours Over Range	:	0					
Hours UnderRange	:	1317					
Upper Bound	:	250.0					
Lower Bound	:	70.0					

=====

Highest 10 values

1	-	04/05/2013:	5	228.5
2	-	04/05/2013:	6	227.9
3	-	04/05/2013:	8	227.8
4	-	04/05/2013:	7	227.8
5	-	04/05/2013:	9	224.4
6	-	04/01/2013:	7	223.9
7	-	12/18/2013:	8	223.8
8	-	04/01/2013:	6	223.7
9	-	12/18/2013:	7	223.0
10	-	12/18/2013:	6	222.6

=====

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Load Range Analysis Report
Boiler #6 UNC Cogen
Date of Report: 04/07/2015 Report Period: 01/01/2014 - 12/31/2014
=====
Number of on Line Hours :7489

Low Range Hours : 3735.0 Percent : 62.3 Bounds 70.0 to 124.0
Mid Range Hours : 1442.0 Percent : 24.0 Bounds 124.0 to 178.0
High Range Hours : 819.0 Percent : 13.7 Bounds 178.0 to 250.0
Hours In Range : 5996
Hours Over Range : 0
Hours UnderRange : 1493
 Upper Bound : 250.0
 Lower Bound : 70.0
=====

Highest 10 values

1 - 01/24/2014:19 245.1
2 - 01/25/2014: 5 244.2
3 - 01/24/2014:20 244.1
4 - 01/25/2014: 4 243.6
5 - 01/24/2014: 3 241.8
6 - 01/30/2014: 3 240.8
7 - 01/24/2014:11 240.6
8 - 01/24/2014:23 240.4
9 - 01/24/2014:12 240.3
10 - 01/24/2014: 2 240.2
=====

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Load Range Analysis Report

Boiler #7 UNC Cogen

Date of Report: 04/07/2015 Report Period: 01/01/2013 - 12/31/2013

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Number of on Line Hours :7684

Low Range Hours	:	2967.0	Percent	:	53.2	Bounds	70.0 to 124.0
Mid Range Hours	:	2192.0	Percent	:	39.3	Bounds	124.0 to 178.0
High Range Hours	:	415.0	Percent	:	7.4	Bounds	178.0 to 250.0
Hours In Range	:	5574					
Hours Over Range	:	0					
Hours UnderRange	:	2110					
Upper Bound	:	250.0					
Lower Bound	:	70.0					

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Highest 10 values

1	-	12/13/2013:	4	241.0
2	-	12/13/2013:	5	240.8
3	-	12/13/2013:	6	239.4
4	-	12/13/2013:	7	237.9
5	-	12/13/2013:	8	236.4
6	-	12/13/2013:	0	235.7
7	-	12/13/2013:	1	231.2
8	-	12/13/2013:	9	225.3
9	-	12/13/2013:	2	224.1
10	-	12/13/2013:	3	220.0

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Load Range Analysis Report
Boiler #7 UNC Cogen
Date of Report: 04/07/2015 Report Period: 01/01/2014 - 12/31/2014
=====
Number of on Line Hours : 7912
=====

Low Range Hours : 5471.0 Percent : 74.6 Bounds 70.0 to 124.0
Mid Range Hours : 1288.0 Percent : 17.6 Bounds 124.0 to 178.0
High Range Hours : 574.0 Percent : 7.8 Bounds 178.0 to 250.0
Hours In Range : 7333
Hours Over Range : 0
Hours UnderRange : 579
Upper Bound : 250.0
Lower Bound : 70.0
=====

Highest 10 values

1 - 01/24/2014:19 244.7
2 - 01/25/2014: 5 243.4
3 - 01/24/2014:20 243.4
4 - 01/25/2014: 4 243.1
5 - 01/24/2014: 3 241.7
6 - 01/29/2014:19 240.5
7 - 01/30/2014: 3 240.4
8 - 01/29/2014:18 239.5
9 - 01/24/2014: 2 239.5
10 - 01/29/2014:22 239.5
=====

Attachment C

The University of North Carolina at Chapel Hill

Coal Analyses During Performance Tests

July 9-10, 2013 Tests

Coal Analyses
Boiler No.6 - July 9, 2013 Test

Parameter	Run #1	Run #2	Run #3	Average
Moisture, %	12.0	4.72	8.57	8.43
HHV, Btu/lb	12,020	12,910	12,850	12,593
Chlorine, %	0.20	0.19	0.18	0.19
Mercury, mg/kg	0.0820	0.0830	0.0740	0.0797
Arsenic, mg/kg	BRL	1.50	2.02	1.76
Beryllium, mg/kg	0.896	0.854	0.772	0.841
Cadmium, mg/kg	BRL	BRL	BRL	BRL
Chromium, mg/kg	14.9	11.7	6.30	10.97
Lead, mg/kg	BRL	3.32	3.75	3.54
Manganese, mg/kg	20.1	4.70	3.83	9.54
Nickel, mg/kg	14.7	17.8	3.53	12.01
Selenium, mg/kg	BRL	2.06	1.54	1.80

BRL = Below Reporting Limit

Coal Analyses
Boiler No.7 - July 10, 2013 Test

Parameter	Run #1	Run #2	Run #3	Average
Moisture, %	3.36	3.37	3.00	3.24
HHV, Btu/lb	12,780	12,970	12,950	12,900
Chlorine, %	0.18	0.20	0.19	0.19
Mercury, mg/kg	0.0970	0.0590	0.0740	0.0767
Arsenic, mg/kg	BRL	1.76	1.28	1.52
Beryllium, mg/kg	0.849	0.765	0.879	0.831
Cadmium, mg/kg	BRL	BRL	BRL	BRL
Chromium, mg/kg	50.3	7.13	7.88	21.77
Lead, mg/kg	4.34	3.50	3.98	3.94
Manganese, mg/kg	8.74	2.45	2.81	4.67
Nickel, mg/kg	28.8	4.60	4.06	12.49
Selenium, mg/kg	1.82	1.89	1.13	1.61

BRL = Below Reporting Limit

Attachment D

The University of North Carolina at Chapel Hill

**Operating Limit Parameters Recorded During
Performance Tests**

July 9-10, 2013 Tests

**Operating Limit Parameters Recorded
Boiler No.6 - July 9, 2013 Test**

Parameter	Run #1	Run #2	Run #3	Average
Coal:Lime Ratio, lb/lb				
HCl Test	12.55	10.35	10.35	11.08
Hg Test	12.72	10.35	10.35	11.14
O ₂ Trim, %	6.56	6.83	6.88	6.76

Coal:Limestone Ratios during Hg and HCl performance tests. Slightly different test run times for the HCl and Hg test runs.

O₂ Trim during CO performance tests.

**Operating Limit Parameters Recorded
Boiler No.7 - July 10, 2013 Test**

Parameter	Run #1	Run #2	Run #3	Average
Coal:Lime Ratio, lb/lb	10.79	10.79	10.79	10.79
O ₂ Trim, %	8.89	9.09	9.08	9.02

Coal:Limestone Ratios during both Hg and HCl performance tests

O₂ Trim during CO performance tests.

Attachment E

The University of North Carolina at Chapel Hill

Boiler Nos. 6 and 7

March 4-5, 2014 Tests

112(j) Performance Test Results

TABLE A-1
 FILTERABLE PARTICULATE TEST RESULTS SUMMARY
 COGENERATION FACILITY - CAMERON AVENUE
 UNIT 6 BREECHING
 CHAPEL HILL, NC

RUN NUMBER		U6-M5/26A-1	U6-MS/26A-2	U6-M5/26A-3	AVERAGE
RUN DATE		3/4/2014	3/4/2014	3/4/2014	
Run Time		1143-1259	1338- 1452	1521-1636	
MEASURED DATA					
(Y)	Meter Box Y	1.0094	1.0094	1.0094	1.0094
(DeltaH)	Avg Delta H, inches H ₂ O	2.942	2.364	2.448	2.585
(Pbar)	Barometric Pressure, inches Hg	29.43	29.43	29.43	29.43
(Vm)	Volume Metered, cubic feet	59.090	53.966	54.641	55.899
(Tm)	Average Meter Temp. deg F	77.1	84.0	84.3	81.80
(Pg)	Static Pressure, inches H ₂ O	-14.7	-15.2	-15.5	-15.13
(Ts)	Average Stack Temp, deg F	360.0	357.0	356.1	357.7
(Vlc)	Water Collected. mL	88.2	81.7	80.5	83.5
(CO ₂)	Carbon Dioxide,%	13.8	13.7	13.7	13.73
(O ₂)	Oxygen, %	5.4	5.5	5.5	5.47
(N ₂)	Nitrogen, %	80.8	80.8	80.8	80.80
(Cp)	Pilot Tube Coefficient	0.84	0.84	0.84	0.84
(DeltaP)	Avg Sqrt Delta P, (inches H2O) ^{1/2}	0.936	0.921	0.935	0.931
(Theta)	Sample Time, min	62.5	62.5	62.5	62.5
(Dn)	Nozzle Diameter, inches	0.273	0.259	0.259	0.264
CALCULATED DATA					
(An)	Nozzle Area, square feet	4.065E-04	3.659E-04	3.659E-04	3.794E-04
(Vmstd)	Standard Meter Volume, ft ³	58.073	52.291	52.929	54.431
(Vwstd)	Standard Water Vapor Volume, ft ³	4.159	3.852	3.796	3.935
(,YoH ₂ O)	Moisture (gravimetrically), %	6.68	6.86	6.69	6.74
(1-I ₂ Osal)	Moisture (at saturation), %	NA	NA	NA	NA
(Bws)	Moisture (actual)	6.68	6.86	6.69	6.74
(Mfd)	Dry Mole Fraction	0.933	0.931	0.933	0.933
(MWd)	Molecular Weight-dry, lb/lb-mole	30.42	30.41	30.41	30.42
(MWs)	Molecular Weight-wet, lb/lb-mole	29.59	29.56	29.58	29.58
(Ps)	Stack Pressure, inches Hg	28.35	28.31	28.29	28.32
(Vs)	Velocity. ft/s	66.46	65.31	66.3t	66.03
(1V)	Stack Area. in ²	4,816.8	4,816.8	4,816.8	4,816.8
(A)	Stack Area, ft ²	33.45	33.45	33.45	33.45
(EA)	Percent Excess Air	33.9	34.7	34.7	34.5
(Qa)	Volumetric flow, acfm	133,389	131,082	133,081	132,517
(Qs)	Volumetric flow, dscfm	75,911	74,629	75,935	75,492
(I)	Isokinetic Rate, %	100.7	102.5	102.0	101.7
(F)	F-factor, DSCF/MMBtu	9,780	9,780	9,780	
FILTERABLE PARTICULATE					
EMISSIONS DATA					
(grams)	Filterable Particulate Catch, g	0.0057	0.0068	0.0148	
(gr/dscf)	Concen., gr/dscf	0.00151	0.00201	0.00432	0.00261
(gr/dscf@702)	Concen., gr/dscf@7 Oxygen	0.00136	0.00181	0.00389	0.00235
(lb/hr)	Emission Rate, lb/hr	0.99	1.28	2.81	1.69
(lb/MMBtu)	Emission Rate, lb/MMBtu	0.00285	0.00381	0.00818	0.00495

RUN NUMBER		U6-M5/26A-1	U6-M5/26A-2	U6-M5/26A-3	AVERAGE
RUN DATE		3/4/2014	3/4/2014	3/4/2014	
RUN TIME		1143-1259	1338-1452	1521-1636	
HYDROGEN CHLORIDE					
EMISSIONS DATA					
(mole weight)	Hydrogen Chloride Mole Weight, lb/lb-mo	36.46	36.46	36.46	
(milligrams)	Hydrogen Chloride Catch, mg	79.6	82.5	90.6	
(ppmvd)	Concen., parts per million by vol. dry	31.9	36.8	39.9	36.2
(ppm@7%O2)	Concen., ppmvd at 7% O2	28.6	33.2	36.0	32.6
(lb/hr)	Emission Rate, lb/hr	13.8	15.6	17.2	15.5
(lb/MMBtu)	Emission Rate, lb/MMBtu	0.0398	0.0462	0.0501	0.0454
HYDROGEN FLUORIDE					
EMISSIONS DATA					
(mole weight)	Hydrogen Fluoride Mole Weight, lb/lb-mo	20.01	20.01	20.01	
(milligrams)	Hydrogen Fluoride Catch, mg	1.40	1.35	1.99	
(ppmvd)	Concen., parts per million by vol. dry	1.02	1.10	1.60	1.24
(ppm@7O2)	Concen., ppmvd at 7% O2	0.92	0.99	1.44	1.12
(lb/hr)	Emission Rate, lb/hr	0.242	0.255	0.378	0.292
(lb/MMBtu)	Emission Rate, lb/MMBtu	0.000701	0.000755	0.001100	0.000852
MERCURY (M30B)					
EMISSIONS DATA					
(mole weight)	Mercury Mole Weight, lb/lb-mole	200.59	200.59	200.59	
(ug/dscm)	Concen., ug/dscm	0.420	0.117	0.088	0.208
(ug/dscm@7% O2)	Concen., ug/dscm@7% O2	0.377	0.106	0.079	0.187
(lb/hr)	Emission Rate, lb/hr	1.19E-04	3.28E-05	2.50E-05	5.91E-05
(lb/mmBtu)	Emission Rate, lb/mmbtu	3.46E-07	9.72E-08	7.29E-08	1.72E-07
CHLORINE as Cl2					
EMISSIONS DATA					
(mole weight)	Chlorine As Cl2 Mole Weight, lb/lb-mole	70.90	70.90	70.90	
(micrograms)	Chlorine As Cl2 Catch, ug	275	125	83	
(ppmvd)	Concen., parts per million by vol. dry	5.67E-02	2.86E-02	1.88E-02	3.47E-02
(ppm@7% O2)	Concen., ppmvd at 7% O2	5.09E-02	2.58E-02	1.70E-02	3.12E-02
(lb/hr)	Emission Rate, lb/hr	4.75E-02	2.36E-02	1.58E-02	2.90E-02
(lb/MMBtu)	Emission Rate, lb/MMBtu	1.38E-04	6.99E-05	4.59E-05	8.45E-05

TABLE A-3
 FILTERABLE PARTICULATE TEST RESULTS SUMMARY
 COGENERATION FACILITY - CAMERON AVENUE
 UNIT 7 OUTLET

CHAPEL HILL, NC

RUN NUMBER		U7-M5/26A-1	U7-M5/26A-2	U7-M5/26A-3	AVERAGE
RUN DATE		3/5/2014	3/5/2014	3/5/2014	
RUNTIME		0925-1039	1055-1206	1223-1341	
MEASURED DATA					
(Y)	Meter Box Y	1.0094	1.0094	1.0094	1.0094
(DeltaH)	Avg Delta H, inches H ₂ O	2.532	2.530	2.498	2.520
(Pbar)	Barometric Pressure, inches Hg	29.80	29.80	29.80	29.8
(Vrn)	Volume Metered, cubic feet	54.133	53.306	54.558	53.999
(Tm)	Average Meter Temp, deg F	75.0	80.8	82.6	79.47
(Pg)	Static Pressure, inches H ₂ O	-14.7	-17.0	-15.9	-15.87
(Ts)	Average Stack Temp, deg F	361.8	364.3	368.3	364.8
(Vlc)	Water Collected, mL	87.5	78.3	81.8	82.6
(CO ₂)	Carbon Dioxide,%	13.6	13.4	13.5	13.50
(O ₂)	Oxygen, %	5.7	5.8	5.7	5.73
(N ₂)	Nitrogen, %	80.7	80.8	80.8	80.77
(Cp)	Pitot Tube Coefficient	0.84	0.84	0.84	0.84
(DeltaP)	Avg Sqrt Delta P, (inches H2O) ^{1/2}	0.946	0.945	0.939	0.944
(Theta)	Sample Time, min	62.5	62.5	62.5	62.5
(Dn)	Nozzle Diameter, inches	0.260	0.261	0.261	0.261
CALCULATED DATA					
(An)	Nozzle Area, square feet	3.687E-04	3.715E-04	3.715E-04	3.706E-04
(Vmstd)	Standard Meter Volume, ft3	54.029	52.628	53.678	53.445
(Vwstd)	Standard Water Vapor Volume, ft ³	4.140	3.692	3.857	3.896
(H ₂ O)	Moisture (gravimetrically), %	7.12	6.56	6.70	6.79
(H ₂ Osat)	Moisture (at saturation), %	NA	NA	NA	NA
(Bws)	Moisture (actual)	7.12	6.56	6.70	6.79
(Mfd)	Dry Mole Fraction	0.929	0.934	0.933	0.932
(MWd)	Molecular Weight-dry, lb/lb-mole	30.40	30.38	30.39	30.39
(MWs)	Molecular Weight-wet, lb/lb-mole	29.52	29.56	29.56	29.55
(Ps)	Stack Pressure, inches Hg	28.72	28.55	28.63	28.63
(Vs)	Velocity, ft/s	66.90	67.09	66.74	66.91
(A)	Stack Area, in ²	4,816.8	4,816.8	4,816.8	4,816.8
(A)	Stack Area, ft2	33.45	33.45	33.45	33.45
(EA)	Percent Excess Air	36.5	37.3	36.5	36.8
(Qa)	Volumetric flow, acfm	134,259	134,654	133,945	134,286
(QS)	Volumetric flow, dscfm	76,875	76,879	76,198	76,651
(I)	Isokinetic Rate,	102.0	98.6	101.5	100.7
(F)	F-factor, DSCF/MMBtu	9,780	9,780	9,780	
FILTERABLE PARTICULATE					
EMISSIONS DATA					
(grams)	Filterable Particulate Catch, g	0.0232	0.0235	0.0209	
(gr/dscf)	Concen., gr/dscf	0.00663	0.00689	0.00601	0.00651
(gr/dscf@7%O2)	Concen., gr/dscf@7% Oxygen	0.00606	0.00634	0.00549	0.00597
(lb/hr)	Emission Rate, lb/hr	4.37	4.54	3.92	4.28
(lb/MMBtu)	Emission Rate, lb/MMBtu	0.0127	0.0133	0.0115	0.0125

RUN NUMBER		U7-M5/26A-1	U7-M5/26A-2	U7-M5/26A-3	AVERAGE
RUN DATE		3/5/2014	3/5/2014	3/5/2014	
RUN TIME		0925-1039	1055-1206	1223-1341	
HYDROGEN CHLORIDE					
EMISSIONS DATA					
(mole weight)	Hydrogen Chloride Mole Weight, lb/lb-mo	36.46	36.46	36.46	
(milligrams)	Hydrogen Chloride Catch, mg	65.9	75.7	75.3	
(ppmvd)	Concen., parts per million by vol. dry	28.4	33.5	32.7	31.5
(ppm@702)	Concen., ppmvd at 7% O2	26.0	- 30.8	29.9	28.9
(lb/hr)	Emission Rate, lb/hr	12.4	14.6	14.1	13.7
(lb/MMBtu)	Emission Rate, lb/MMBtu	0.0362	0.0429	0.0416	0.0402
HYDROGEN FLUORIDE					
EMISSIONS DATA					
(mole weight)	Hydrogen Fluoride Mole Weight, lb/lb-mo	20.01	20.01	20.01	
(milligrams)	Hydrogen Fluoride Catch, mg	0.716	1.12	1.20	
(ppmvd)	Concen., parts per million by vol. dry	0.563	0.903	0.949	0.805
(ppm@7%O2)	Concen., ppmvd at 7% O2	0.514	0.832	0.868	0.738
(lb/hr)	Emission Rate, lb/hr	0.135	0.216	0.225	0.192
(lb/MMBtu)	Emission Rate, lb/MMBtu	0.000393	0.000635	0.000663	0.000564
MERCURY (M30B)					
EMISSIONS DATA					
(mole weight)	Mercury Mole Weight, lb/lb-mole	200.59	200.59	200.59	
(ug/dscm)	Concen., ug/dscm	0.179	0.181	0.213	0.191
(ug/dscm(@7%O2)	Concen., ug/dscm@7%O2	0.164	0.167	0.195	0.175
(lb/hr)	Emission Rate, lb/hr	5.15E-05	5.22E-05	6.08E-05	5.49E-05
(lb/mmBtu)	Emission Rate, lb/mmBtu	1.50E-07	1.53E-07	1.79E-07	1.61.E-07
CHLORINE as Cl2					
EMISSIONS DATA					
(mole weight)	Chlorine As Cl2 Mole Weight, lb/lb-mole	70.90	70.90	70.90	
(micrograms)	Chlorine As Cl2 Catch, ug	165	68	60	
(ppmvd)	Concen., parts per million by vol. dry	3.66E-02	1.55E-02	1.34E-02	2.18E-02
(ppm@7%O2)	Concen., ppmvd at 7% O2	3.38E-02	1.42E-02	1.22E-02	2.00E-02
(lb/hr)	Emission Rate, lb/hr	3.11E-02	1.31E-02	1.13E-02	1.85E-02
(lb/MMBtu)	Emission Rate, lb/MMBtu	9.05E-05	3.86E-05	3.31E-05	5.41E-05

Attachment F

The University of North Carolina at Chapel Hill

Coal Analyses During Performance Tests

March 4-5, 2014 Tests

Coal Analyses
Boiler No.6 – March 4, 2014 Test

Parameter	Run #1	Run #2	Run #3	Average
Moisture, %	4.14	3.78	4.46	4.13
HHV, Btu/lb	13,230	13,310	12,920	13,153
Chlorine, %	0.0900	0.0800	0.0900	0.0867
Mercury, mg/kg	0.156	0.0730	0.183	0.137
Arsenic, mg/kg	12.5	12.3	50.5	25.1
Beryllium, mg/kg	1.48	1.36	0.93	1.26
Cadmium, mg/kg	BRL	BRL	BRL	BRL
Chromium, mg/kg	9.14	8.89	10.2	9.41
Lead, mg/kg	3.21	4.11	3.84	3.72
Manganese, mg/kg	6.09	8.46	4.84	6.46
Nickel, mg/kg	15.8	10.9	8.44	11.71
Selenium, mg/kg	BRL	9.08	8.70	8.89

BRL = Below Reporting Limit

Coal Analyses
Boiler No.7 – March 5, 2014 Test

Parameter	Run #1	Run #2	Run #3	Average
Moisture, %	4.29	5.21	3.95	4.48
HHV, Btu/lb	13,470	12,940	13,050	13,153
Chlorine, %	0.0700	0.0700	0.0400	0.0600
Mercury, mg/kg	0.105	0.0610	0.233	0.133
Arsenic, mg/kg	23.8	14.8	32.5	23.7
Beryllium, mg/kg	1.12	1.20	0.99	1.10
Cadmium, mg/kg	BRL	BRL	BRL	BRL
Chromium, mg/kg	7.11	9.38	7.37	7.95
Lead, mg/kg	2.50	3.78	4.64	3.64
Manganese, mg/kg	23.0	11.0	9.89	14.63
Nickel, mg/kg	15.8	9.26	16.1	13.72
Selenium, mg/kg	BRL	8.64	BRL	8.64

BRL = Below Reporting Limit

Attachment G

The University of North Carolina at Chapel Hill

**Operating Limit Parameters Recorded During
Performance Tests**

March 4-5, 2014 Tests

**Operating Limit Parameters Recorded
Boiler No.6 – March 4, 2014 Test**

Parameter	Run #1	Run #2	Run #3	Average
Coal:Lime Ratio, lb/lb				
HCl Test	9.01	8.98	9.00	9.00
Hg Test	8.86	9.10	8.89	8.95
O ₂ Trim, %	4.04	4.01	4.01	4.02

Coal:Limestone Ratios during Hg and HCl performance tests. Slightly different test run times for the HCl and Hg test runs.

O₂ Trim recorded during CO performance tests. Results of CO test not recorded.

**Operating Limit Parameters Recorded
Boiler No.7 – March 5, 2014 Test**

Parameter	Run #1	Run #2	Run #3	Average
Coal:Lime Ratio, lb/lb	9.53	9.53	9.53	9.53
O ₂ Trim, %	4.64	4.63	4.57	4.61

Coal:Limestone Ratios during both Hg and HCl performance tests.

O₂ Trim recorded during CO performance tests. Results of CO test not recorded.

Attachment H

The University of North Carolina at Chapel Hill

Boiler Nos. 6 and 7

December 17-18, 2014 Tests

112(j) Performance Test Results

TABLE 2-1
UNIT 6
FILTERABLE PARTICULATE, HYDROGEN CHLORIDE, CHLORINE, CARBON
MONOXIDE AND MERCURY TEST RESULTS
DECEMBER 2014

	U6-RUN-2	U6-RUN-3	U6-RUN-4	Average
Test Date	12/17/14	12/17/14	12/17/14	
Start Time	1110	1245	1410	
Finish Time	1222	1352	1515	
Filterable Particulate				
Concentration, gr/dscf	1.44E-03	1.28E-03	7.43E-04	1.15E-03
Emission Rate, lb/hr	0.884	0.779	0.465	0.710
Emission Rate, lb/mmBtu	2.68E-03	2.38E-03	1.38E-03	2.15E-03
Hydrogen Chloride				
Concentration, ppmvd	57.4	57.5	53.0	56.0
Emission Rate, lb/hr	23.4	23.2	22.0	22.9
Emission Rate, lb/mmBtu	7.08E-02	7.08E-02	6.53E-02	6.90E-02
Chlorine				
Concentration, ppmvd	1.40E-05	7.62E-06	6.00E-06	9.19E-06
Emission Rate, lb/hr	1.11E-05	5.98E-06	4.84E-06	7.29E-06
Emission Rate, lb/mmBtu	3.34E-08	1.83E-08	1.44E-08	2.20E-08
Carbon Monoxide				
Concentration, ppmvd	20.0	29.4	34.1	27.86
Concentration, ppmvd@ 7% O ₂	17.73	26.05	30.21	24.66
Emission Rate, lb/hr	6.3	9.1	10.9	8.75
Emission Rate, lb/mmBtu	1.90E-02	2.78E-02	3.23E-02	2.64E-02
Mercury				
Concentration, ug/dscm	0.156	0.219	0.265	0.213
Emission Rate, lb/hr	4.19E-05	5.83E-05	7.26E-05	5.76E-05
Emission Rate, lb/mmBtu	1.27E-07	1.78E-07	2.16E-07	1.73E-07

TABLE 2-1
UNIT 7
FILTERABLE PARTICULATE, HYDROGEN CHLORIDE, CHLORINE, CARBON
MONOXIDE AND MERCURY TEST RESULTS
DECEMBER 2014

	U7-RUN-1	U7-RUN-2	U7-RUN-3	Average
Test Date	12/18/14	12/18/14	12/18/14	
Start Time	0803	0928	1050	
Finish Time	0909	1032	1154	
Filterable Particulate				
Concentration, gr/dscf	4.72E-03	3.50E-03	3.57E-03	3.93E-03
Emission Rate, lb/hr	3.086	2.198	2.204	2.496
Emission Rate, lb/mmBtu	8.73E-03	6.50E-03	6.59E-03	7.27E-03
Hydrogen Chloride				
Concentration, ppmvd	50.0	44.3	48.1	47.5
Emission Rate, lb/hr	21.6	18.5	19.7	19.9
Emission Rate, lb/mmBtu	6.12E-02	5.46E-02	5.89E-02	5.82E-02
Chlorine				
Concentration, ppmvd	7.01E-06	<6.60E-06	<7.35E-06	<6.99E-06
Emission Rate, lb/hr	5.90E-06	<5.35E-06	<5.85E-06	<5.70E-06
Emission Rate, lb/mmBtu	1.67E-08	<1.58E-08	<1.75E-08	<1.67E-08
Carbon Monoxide				
Concentration, ppmvd	18.5	24.1	27.8	23.5
Concentration, ppmvd@ 7% O ₂	16.31	21.36	24.49	20.72
Emission Rate, lb/hr	6.2	7.7	8.8	7.55
Emission Rate, lb/mmBtu	1.74E-02	2.28E-02	2.62E-02	2.22E-02
Mercury				
Concentration, ug/dscm	0.142	0.217	0.292	0.217
Emission Rate, lb/hr	4.04E-05	5.95E-05	7.89E-05	5.96E-05
Emission Rate, lb/mmBtu	1.14E-07	1.76E-07	2.36E-07	1.75E-07

Attachment I

The University of North Carolina at Chapel Hill

Coal Analyses During Performance Tests

December 17-18, 2014 Tests

Coal Analyses
Boiler No.6 – December 17, 2014 Test

Parameter	Run #2	Run #3	Run #4	Average
Moisture, %	8.14	8.14	8.33	8.20
HHV, Btu/lb	12,175	12,291	11,977	12,148
Chlorine, %	0.1019	0.1155	0.1058	0.1077
Mercury, mg/kg	0.19	0.18	0.20	0.19
Arsenic, mg/kg	25.3	25.2	30.9	27.13
Beryllium, mg/kg	2.41	2.33	2.61	2.45
Cadmium, mg/kg	<0.01	<0.01	<0.01	<0.01
Chromium, mg/kg	21.3	20.0	22.6	21.3
Lead, mg/kg	12.9	12.1	14.1	13.03
Manganese, mg/kg	23.0	27.2	22.8	24.33
Nickel, mg/kg	18.8	17.4	18.70	18.30
Selenium, mg/kg	2.00	1.90	2.00	1.97

Run #1 terminated.

BRL = Below Reporting Limit

Coal Analyses
Boiler No.7 – December 18, 2014 Test

Parameter	Run #1	Run #2	Run #3	Average
Moisture, %	9.03	6.71	9.12	8.29
HHV, Btu/lb	11,777	11,610	11,040	11,476
Chlorine, %	0.1069	0.0582	0.0538	0.0730
Mercury, mg/kg	0.17	0.17	0.19	0.18
Arsenic, mg/kg	23.3	43.3	44.0	36.87
Beryllium, mg/kg	2.63	2.48	2.09	2.40
Cadmium, mg/kg	<0.01	<0.01	<0.01	<0.01
Chromium, mg/kg	21.9	28.5	31.3	27.23
Lead, mg/kg	13.7	14.5	13.7	13.97
Manganese, mg/kg	25.4	37.2	41.9	34.83
Nickel, mg/kg	20.4	24.7	25.8	23.63
Selenium, mg/kg	2.00	1.30	1.60	1.63

BRL = Below Reporting Limit

Attachment J

The University of North Carolina at Chapel Hill

**Operating Limit Parameters Recorded During
Performance Tests**

December 17-18, 2014 Tests

**Operating Limit Parameters Recorded
Boiler No.6 – December 17, 2014 Test**

Parameter	Run #2	Run #3	Run #4	Average
Coal:Lime Ratio, lb/lb	8.51	8.51	8.69	8.57
O ₂ Trim, %	4.337	4.320	4.302	4.320

Run #1 terminated

Coal:Limestone Ratios during both Hg and HCl performance tests.

O₂ Trim recorded during CO performance tests.

**Operating Limit Parameters Recorded
Boiler No.7 – December 18, 2014 Test**

Parameter	Run #1	Run #2	Run #3	Average
Coal:Lime Ratio, lb/lb	8.54	8.54	8.54	8.54
O ₂ Trim, %	4.412	3.911	3.734	4.019

Coal:Limestone Ratios during both Hg and HCl performance tests.

O₂ Trim recorded during CO performance tests.